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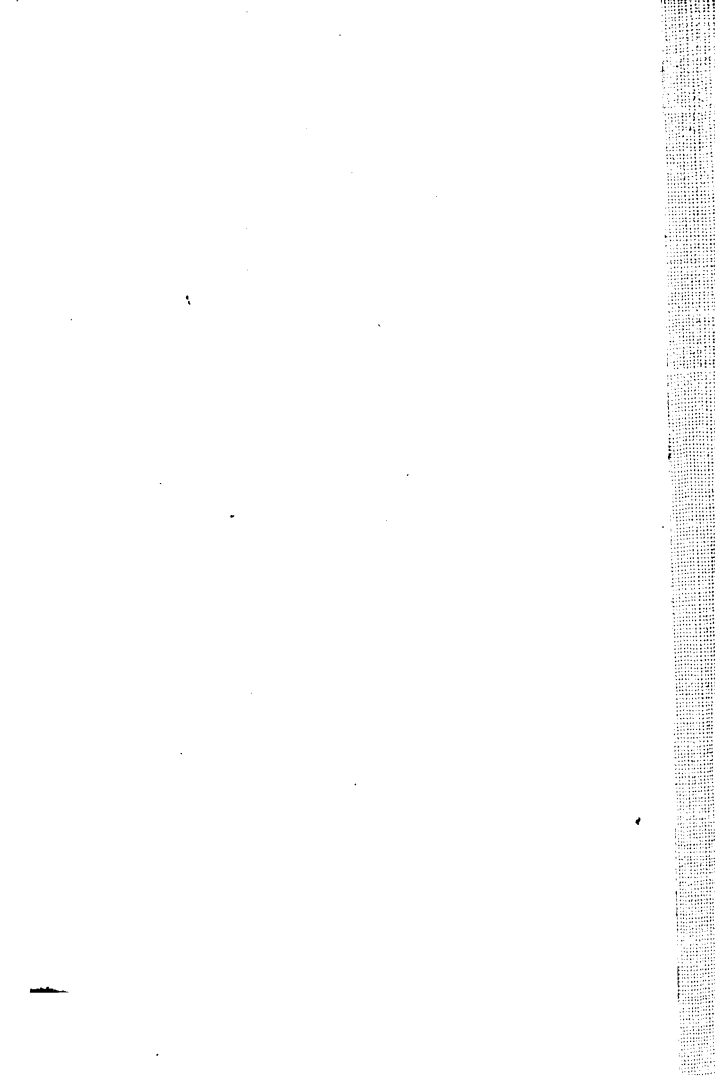
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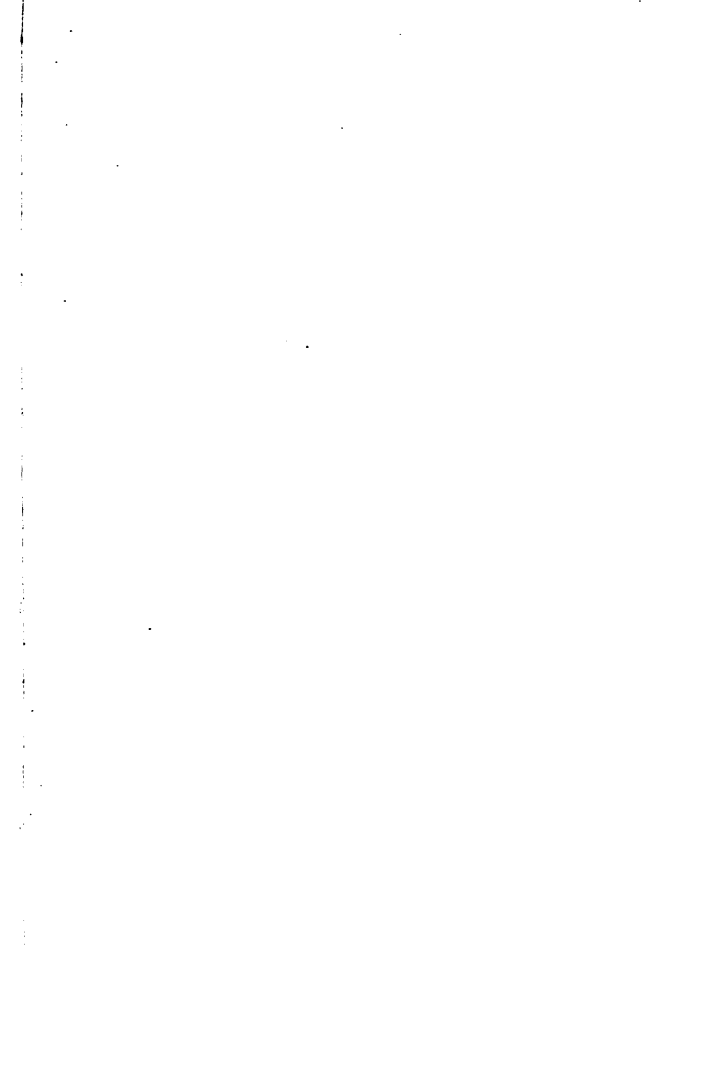
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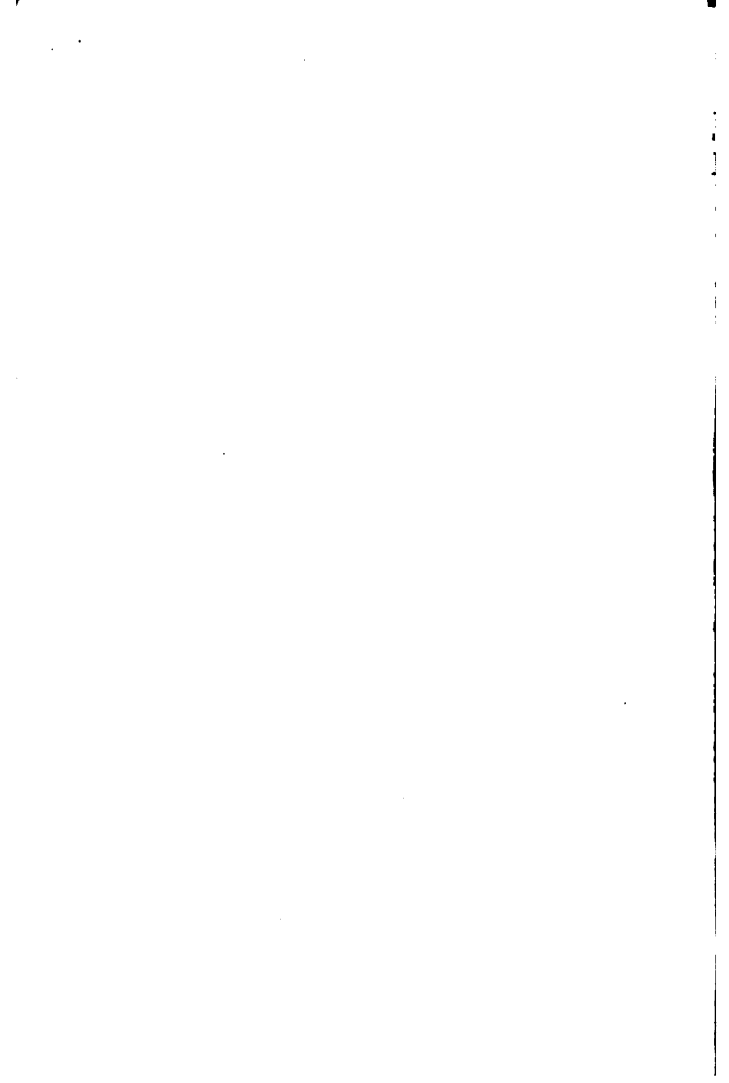
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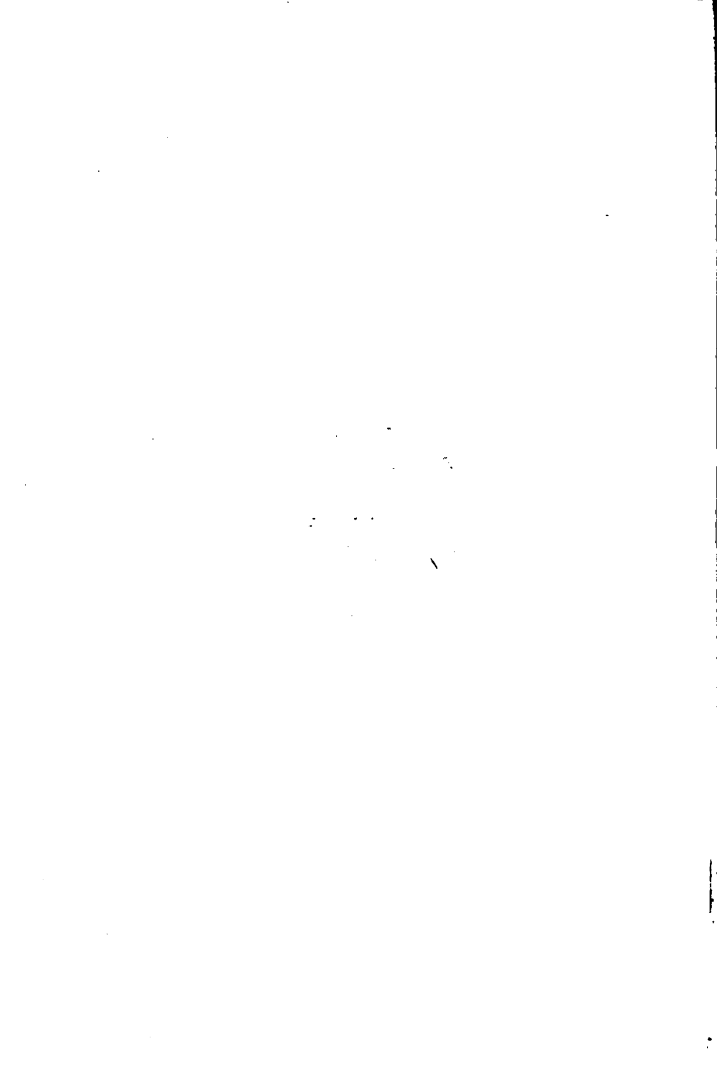








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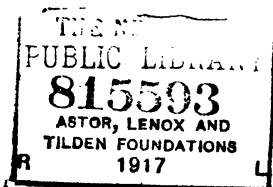
Scientists, Inventors, and Explorers

CHRISTOPHER COLUMBUS	CHARLES DARWIN
JAMES COOK	HENRY M. STANLEY
JAMES WATT	THOMAS A. EDISON
ELIAS HOWE	ROBERT E. PEARY



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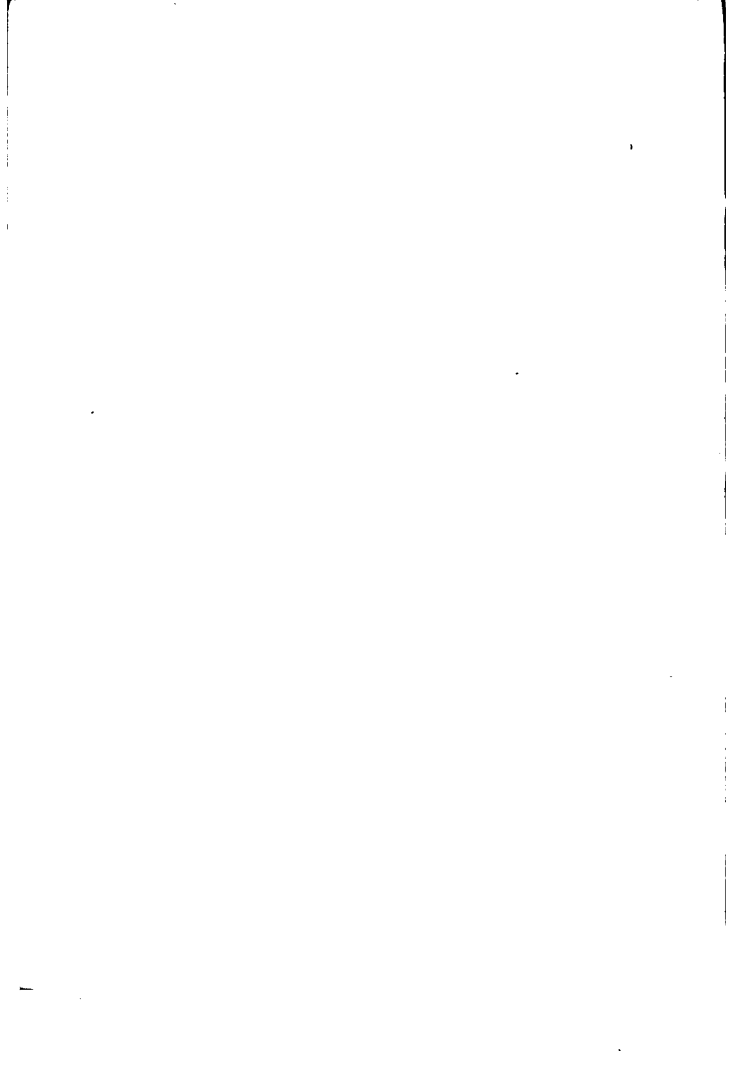
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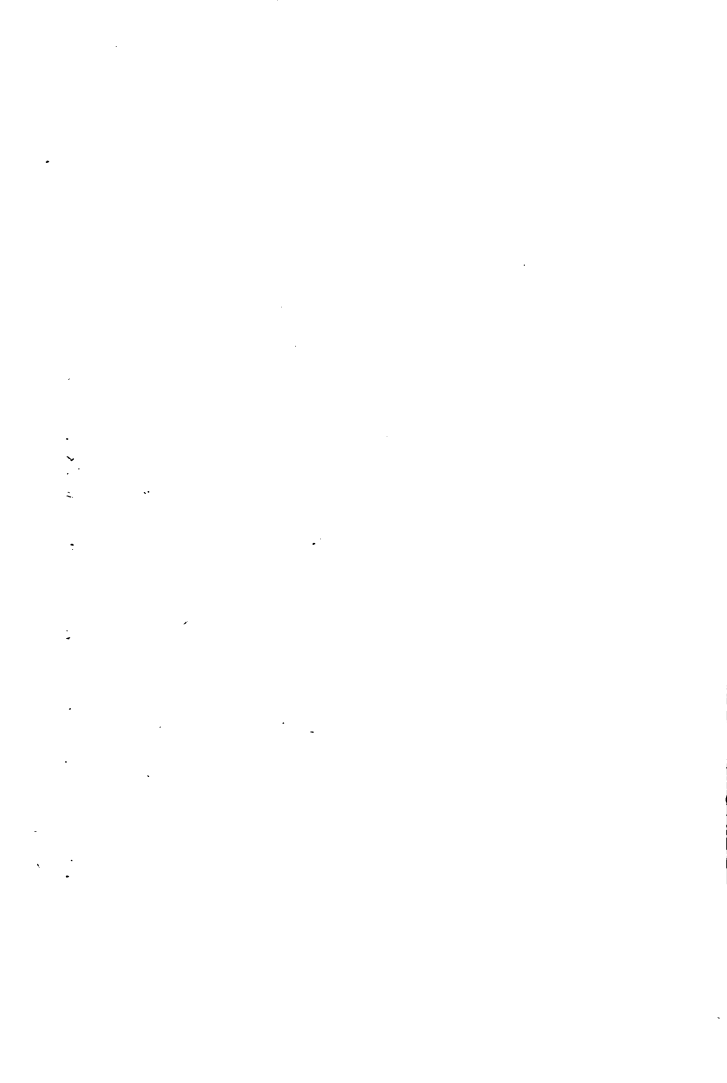
VOLUME V

SCIENTISTS, INVENTORS, AND EXPLORERS

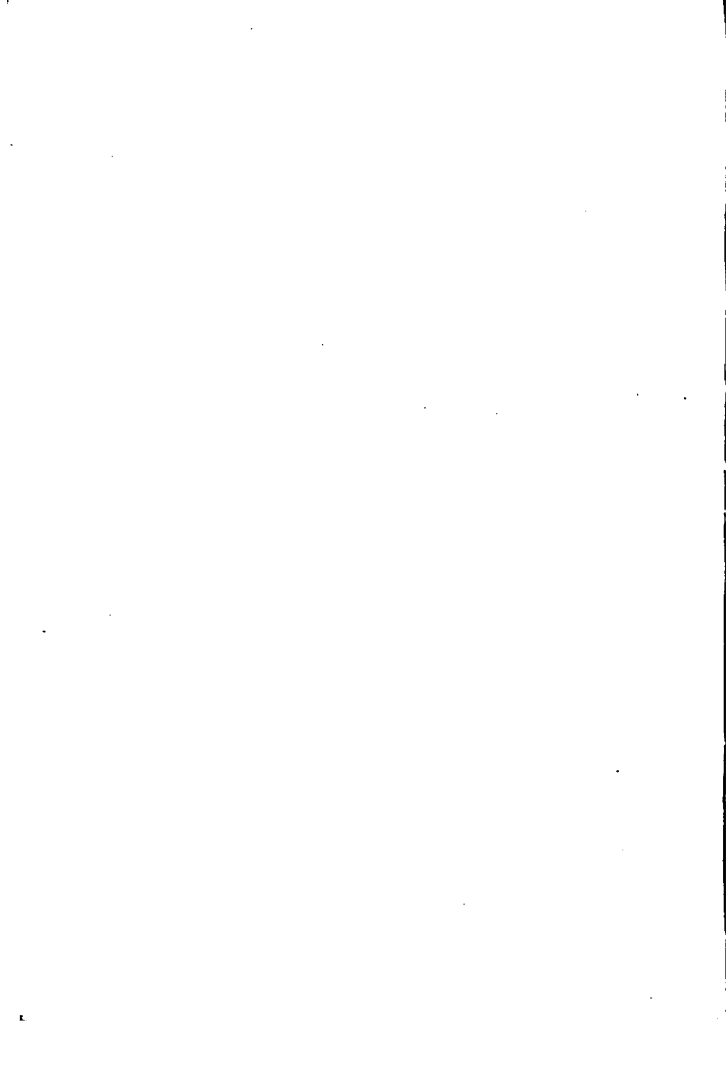
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VOLUME V
**SCIENTISTS, INVENTORS, AND EX-
PLORERS**



CHRISTOPHER COLUMBUS
(1435-1506)



CHRISTOPHER COLUMBUS

THE DISCOVERY OF AMERICA

BEREFT of honors, in poverty and neglect, Columbus ended his days in the mistaken belief that he had discovered a new way to reach the Indies. We know that his accomplishment was incomparably greater than this. He had discovered a new world.

The narrative which follows, from the pen of Washington Irving, recounts the basis and development of the great idea, and describes the trials of the Admiral on his first voyage.

*It has been attempted, in the preceding chapters, to show how Columbus was gradually kindled up to his grand design by the spirit and events of the times in which he lived. His son Fernando, however, undertakes to furnish the precise data on which his father's plan of discovery was founded. "He does this," he observes, "to show from what slender argument so great a scheme was fabricated and brought to light; and for the purpose of satisfying those who may desire to know distinctly

*From Irving's "Life and Voyages of Christopher Columbus."

the circumstances and motives which led his father to understand this enterprise."

As this statement was formed from notes and documents found among his father's papers, it is too curious and interesting not to deserve particular mention. In this memorandum he arranged the foundation of his father's theory under three heads: (1) The nature of things; (2) The authority of learned writers; (3) The reports of navigators.

Under the first head he set down as a fundamental principle that the earth was a terraqueous sphere or globe, which might be travelled round from east to west, and that men stood foot to foot when on opposite points. The circumference from east to west, at the equator, Columbus divided, according to Ptolemy, into twenty-four hours of fifteen degrees each, making three hundred and sixty degrees. Of these he imagined, comparing the globe of Ptolemy with the earlier map of Marinus of Tyre, that fifteen hours had been known to the ancients, extending from the straits of Gibraltar, or rather from the Canary Islands, to the city of Thinae in Asia, a place set down as the eastern limits of the known world. The Portuguese had advanced the western frontier one hour more by the discovery of the Azores and Cape Verde Islands. There remained, then, according to the estimation of Columbus, eight

hours, or one third of the circumference of the earth, unknown and unexplored. This space might, in a great measure, be filled up by the eastern regions of Asia, which might extend so far as nearly to surround the globe, and to approach the western shores of Europe and Africa. The tract of ocean intervening between these countries, he observes, would be less than might at first be supposed, if the opinion of Alfraganus, the Arabian, were admitted, who, by diminishing the size of the degrees, gave to the earth a smaller circumference than did other cosmographers, a theory to which Columbus seems at times to have given faith. Granting these premises, it was manifest that, by pursuing a direct course from east to west, a navigator would arrive at the extremity of Asia and discover any intervening land.

Under the second head are named the authors whose writings had weight in convincing him that the intervening ocean could be but of moderate expanse and easy to be traversed. Among these he cites the opinion of Aristotle, Seneca, and Pliny, that one might pass from Cadiz to the Indies in a few days; of Strabo also, who observes that the ocean surrounds the earth, bathing on the east the shores of India; on the west, the coasts of Spain and Mauritania; so that it is easy to navigate from one to the other on the same parallel.

In corroboration of the idea that Asia, or, as he always terms it, India, stretched far to the east, so as to occupy the greater part of the unexplored space, the narratives are cited of Marco Polo and John Mandeville. These travellers had visited, in the thirteenth and fourteenth centuries, the remote parts of Asia, far beyond the regions laid down by Ptolemy; and their accounts of the extent of that continent to the eastward had a great effect in convincing Columbus that a voyage to the west, of no long duration, would bring him to its shores, or to the extensive and wealthy islands which lie adjacent. The information concerning Marco Polo is probably derived from Paulo Toscanelli, a celebrated doctor from Florence, already mentioned, with whom Columbus corresponded in 1474, and who transmitted to him a copy of a letter which he had previously written to Fernando Martinez, a learned canon of Lisbon. This letter maintains the facility of arriving at India by a western course, asserting the distance to be but four thousand miles, in a direct line from Lisbon to the province of Mangi, near Cathay, since determined to be the northern coast of China. Of this country he gives a magnificent description, drawn from the work of Marco Polo. He adds that in the route lay the islands of Antilla and Cipango, distant from each other

only two hundred and twenty-five leagues, abounding in riches and offering convenient places for ships to touch at and obtain supplies on the voyage.

Under the third head are enumerated various indications of land in the west, which had floated to the shores of the known world. It is curious to observe how, when once the mind of Columbus had become heated in the inquiry, it attracted to it every corroborating circumstance, however vague and trivial. He appears to have been particularly attentive to the gleams of information derived from veteran mariners, who had been employed in the recent voyages to the African coasts, and also from the inhabitants of lately discovered islands, placed, in a manner, on the frontier posts of geographical knowledge. All these are carefully noted down among his memorandums, to be collocated with the facts and opinions already stored up in his mind.

Such, for instance, is the circumstance related to him by Martin Vicenti, a pilot in the service of the King of Portugal: that, after sailing four hundred and fifty leagues to the west of Cape St. Vincent, he had taken from the water a piece of carved wood, which had evidently not been labored with an iron instrument. As the winds had drifted it from the west, it might have come from some unknown land in that direction.

Pedro Correo, brother-in-law of Columbus, is likewise cited as having seen, on the Island of Porto Santo, a similar piece of wood, which had drifted from the same quarter. He had heard also, from the King of Portugal, that reeds of an immense size had floated to some of those islands from the west, in the description of which Columbus thought he recognized the immense reeds said by Ptolemy to grow in India.

Information is likewise noted, given him by the inhabitants of the Azores, of trunks of huge pine trees, of a kind that did not grow upon any of the islands, wafted to their shores by the westerly winds; but especially of the bodies of two dead men, cast upon the Island of Flores, whose features differed from those of any known race of people.

To these is added the report of a mariner of the port of St. Mary, who asserted that, in the course of a voyage to Ireland, he had seen land to the west, which the ship's company took for some extreme part of Tartary. Other stories, of a similar kind, are noted, as well as rumors concerning the fancied islands of St. Brandan, and of the Seven Cities, to which, as has already been observed, Columbus gave but little faith.

Such is an abstract of the grounds on which, according to Fernando, his father proceeded

from one position to another, until he came to the conclusion that there was undiscovered land in the western part of the ocean, that it was attainable, that it was fertile, and, finally, that it was inhabited.

It was evident that several of the facts herein enumerated must have become known to Columbus after he had formed his opinion, and merely served to strengthen it; still, everything that throws any light upon the process of thought, which led to so great an event, is of the highest interest; and the chain of deductions here furnished, though not perhaps the most logical in its concatenation, yet, being extracted from the papers of Columbus himself, remains one of the most interesting documents in the history of the human mind. . . .

It was on Friday, the 3d of August, 1492, early in the morning, that Columbus set sail from the bar of Saltes, a small island formed by the arms of the Odiel, in front of the town of Huelva, steering in a southwesterly direction for the Canary Islands, whence it was his intention to strike due west. As a guide by which to sail, he had prepared a map or chart, improved upon that sent him by Paulo Toscanelli. Neither of those now exist, but the globe or planisphere finished by Martin Behem in this year of the Admiral's first voyage is still extant, and furnishes an idea of what the chart of Columbus

must have been. It exhibits the coasts of Europe and Africa from the south of Ireland to the end of Guinea, and opposite to them, on the other side of the Atlantic, the extremity of Asia, or, as it was termed, India. Between them is placed the Island of Cipango, or Japan, which, according to Marco Polo, lay fifteen hundred miles distant from the Asiatic coast. In his computations Columbus advanced this island about a thousand leagues too much to the east supposing it to be about the situation of Florida; and at this island he hoped first to arrive.

The exultation of Columbus at finding himself, after so many years of baffled hope, fairly launched on his grand enterprise, was checked by his want of confidence in the resolution and perseverance of his crews. As long as he remained within reach of Europe, there was no security that, in a moment of repentance and alarm, they might not renounce the prosecution of the voyage, and insist on a return. Symptoms soon appeared to warrant his apprehensions. On the third day the *Pinta* made signal of distress; her rudder was discovered to be broken and unhung. This Columbus surmised to be done through the contrivance of the owners of the caravel, Gomez Rascon and Christoval Quintero, to disable their vessel, and cause her to be left behind. As has already been observed, they had been pressed into the service greatly

against their will, and their caravel seized upon for the expedition, in conformity to the royal orders.

Columbus was much disturbed at this occurrence. It gave him a foretaste of further difficulties to be apprehended from crews partly enlisted on compulsion, and all full of doubt and foreboding. Trivial obstacles might, in the present critical state of his voyage, spread panic and mutiny through his ships, and entirely defeat the expedition.

The wind was blowing strongly at the time, so that he could not render assistance without endangering his own vessel. Fortunately, Martin Alonzo Pinzon commanded the *Pinta*, and being an adroit and able seaman, succeeded in securing the rudder with cords, so as to bring the vessel into management. This, however, was but a temporary and inadequate expedient; the fastenings gave way again on the following day, and the other ships were obliged to shorten sail until the rudder could be secured.

This damaged state of the *Pinta*, as well as her being in a leaky condition, determined the Admiral to touch at the Canary Islands, and seek a vessel to replace her. He considered himself not far from those islands, though a different opinion was entertained by the pilots of the squadron. The event proved his superiority in taking observations and keeping

reckonings, for they came in sight of the Canaries on the morning of the 9th.

They were detained upward of three weeks among these islands, seeking in vain another vessel. They were obliged, therefore, to make a new rudder for the *Pinta*, and repair her for the voyage. The lateen sails of the *Niña* were also altered into square sails, that she might work more steadily and securely, and be able to keep company with the other vessels.

While sailing among these islands the crew were terrified at beholding the lofty peak of Teneriffe sending forth volumes of flame and smoke, being ready to take alarm at any extraordinary phenomenon, and to construe it into a disastrous portent. Columbus took great pains to dispel their apprehensions, explaining the natural causes of those volcanic fires, and verifying his explanations by citing Mount Etna, and other well-known volcanoes.

While taking in wood and water and provision in the Island of Gomera, a vessel arrived from Ferro, which reported that three Portuguese caravels had been seen hovering off that island, with the intention, it was said, of capturing Columbus. The Admiral suspected some hostile stratagem on the part of the King of Portugal, in revenge for his having embarked in the service of Spain; he therefore lost no time in putting to sea, anxious to get far from those

islands, and out of the track of navigation, trembling lest something might occur to defeat his expedition, commenced under such inauspicious circumstances.

Early in the morning of the 6th of September Columbus set sail from the Island of Gomera, and now might be said first to strike into the region of discovery; taking leave of these frontier islands of the Old World, and steering westward for the unknown parts of the Atlantic. For three days, however, a profound calm kept the vessels loitering, with flagging sails, within a short distance of the land. This was a tantalizing delay to Columbus, who was impatient to find himself far out of sight of either land or sail, which, in the pure atmosphere of these latitudes, may be descried at an immense distance. On the following Sunday, the 9th of September, at daybreak, he beheld Ferro, the last of the Canary Islands, about nine leagues distant. This was the island whence the Portuguese caravels had been seen; he was therefore in the very neighborhood of danger. Fortunately a breeze sprang up with the sun, their sails were once more filled, and in the course of the day, the heights of Ferro gradually faded from the horizon.

On losing sight of this last trace of land, the hearts of the crews failed them. They seemed literally to have taken leave of the world. Behind them was everything dear to the heart

of man—country, family, friends, life itself; before them everything was chaos, mystery, and peril. In the perturbation of the moment, they despaired of evermore seeing their homes. Many of the rugged seamen shed tears, and some broke into loud lamentations. The Admiral tried in every way to soothe their distress, and to inspire them with his own glorious anticipations. He described to them the magnificent countries to which he was about to conduct them: the islands of the Indian seas, teeming with gold and precious stones; the regions of the Mangi and Cathay, with their cities of unrivalled wealth and splendor. He promised them land and riches, and everything that could arouse their cupidity, or inflame their imaginations. Nor were these promises made for purposes of mere deception; he certainly believed that he should realize them all.

He now issued orders to the commanders of the other vessels, that, in the event of separation by any accident, they should continue directly westward; but that after sailing seven hundred leagues, they should lay by from midnight until daylight, as at about that distance he confidently expected to find land. In the meantime, as he thought it possible he might not discover land within the distance thus assigned, and as he foresaw that the vague terrors already awakened among the seamen would increase with the space

which intervened between them and their homes, he commenced a stratagem which he continued throughout the voyage. He kept two reckonings: one correct, in which the true way of the ship was noted, and which was retained in secret for his own government; in the other, which was open to general inspection, a number of leagues was daily subtracted from the sailing of the ship, so that the crews were kept in ignorance of the real distance they had advanced.

On the 11th of September, when about one hundred and fifty leagues west of Ferro, they fell in with part of a mast, which from its size appeared to have belonged to a vessel of about a hundred and twenty tons burden, and which had evidently been a long time in the water. The crews, tremblingly alive to everything that could excite their hopes or fears, looked with rueful eye upon this wreck of some unfortunate voyager drifting ominously at the entrance of those unknown seas.

On the 13th of September, in the evening, being about two hundred leagues from the Island of Ferro, Columbus, for the first time, noticed the variation of the needle; a phenomenon which had never before been remarked. He perceived, about nightfall, that the needle, instead of pointing to the north star, varied about half a point, or between five and six degrees, to the northwest, and still more on the following

morning. Struck with this circumstance, he observed it attentively for three days, and found that the variation increased as he advanced. He at first made no mention of this phenomenon, knowing how ready his people were to take alarm, but it soon attracted the attention of the pilots, and filled them with consternation. It seemed as if the very laws of nature were changing as they advanced, and that they were entering another world, subject to unknown influences. They apprehended that the compass was about to lose its mysterious virtues, and without this guide, what was to become of them in a vast and trackless ocean?

Columbus tasked his science and ingenuity for reasons with which to allay their terror. He observed that the direction of the needle was not to the polar star, but to some fixed and invisible point. The variation, therefore, was not caused by any fallacy in the compass, but by the movement of the north star itself, which, like the other heavenly bodies, had its changes and revolutions, and every day described a circle round the pole. The high opinion which the pilots entertained of Columbus as a profound astronomer gave weight to this theory, and their alarm subsided. As yet the solar system of Copernicus was unknown. The explanation of Columbus, therefore, was highly plausible and ingenious, and it shows the vivacity of his mind,

ever ready to meet the emergency of the moment. The theory may at first have been advanced merely to satisfy the minds of others, but Columbus appears subsequently to have remained satisfied with it himself. The phenomenon has now become familiar to us, but we still continue ignorant of its cause. It is one of those mysteries of nature, open to daily observation and experiment, and apparently simple from their familiarity, but which on investigation make the human mind conscious of its limits; baffling the experience of the practical, and humbling the pride of science.

On the 14th of September the voyagers were rejoiced at the sight of what they considered harbingers of land. A heron, and a tropical bird called the Rabo de Junco, neither of which is supposed to venture far to sea, hovered about the ships. On the following night they were struck with awe at beholding a meteor, or, as Columbus calls it in his journal, a great flame of fire, which seemed to fall from the sky into the sea, about four or five leagues distant. These meteors, common in warm climates, and especially under the tropics, are always seen in the serene azure sky of those latitudes, falling as it were from the heavens, but never beneath a cloud. In the transparent atmosphere of one of those beautiful nights, where every star shines with the purest lustre, they often leave a

luminous train behind them which lasts for twelve or fifteen seconds, and may well be compared to a flame.

The wind had hitherto been favorable, with occasional, though transient, clouds and showers. They had made great progress each day, though Columbus, according to his secret plan, contrived to suppress several leagues in the daily reckoning left open to the crew.

They had now arrived within the influence of the trade-wind, which, following the sun, blows steadily from east to west, between the tropics, and sweeps over a few adjoining degrees of ocean. With this propitious breeze directly aft, they were wafted gently but speedily over a tranquil sea, so that for many days they did not shift a sail. Columbus perpetually recurs to the bland and temperate serenity of the weather, which in this tract of the ocean is soft and refreshing without being cool. In his artless and expressive language he compares the pure and balmy morning to those of April in Andalusia, and observes that they wanted but the song of the nightingale to complete the illusion. . . .

They now began to see large patches of herbs and weeds drifting from the west, and increasing in quantity as they advanced. Some of these weeds were such as grow about rocks, others such as are produced in rivers; some were

yellow and withered, others so green as to have apparently been recently washed from land. On one of these patches was a live crab, which Columbus carefully preserved. They also saw a white tropical bird, of a kind which never sleeps upon the sea. Tunny fish also played about the ships, one of which was killed by the crew of the *Niña*. Columbus now called to mind the account given by Aristotle of certain ships of Cadiz, which, coasting the shores outside the straits of Gibraltar, were driven westward by an impetuous east wind, until they reached a part of the ocean covered with vast fields of weeds resembling sunken islands, among which they beheld many tunny fish. He supposed himself arrived in this weedy sea, as it had been called, for which the ancient mariners had turned back in dismay, but which he regarded with animated hope, as indicating the vicinity of land. Not that he had yet any idea of reaching the object of his search, the eastern end of Asia; for, according to his computation, he had come but three hundred and sixty leagues since leaving the Canary Islands, and he placed the mainland of India much farther on.

On the 18th of September the same weather continued; a soft steady breeze from the east filled every sail, while, to use the words of Columbus, the sea was as calm as the Guadalquivir at Seville. He fancied that the water of the

sea grew fresher as he advanced, and noticed this as a proof of the superior sweetness and purity of the air.

The crews were all in high spirits; each ship strove to get in the advance, and every seaman was eagerly on the lookout; for the sovereigns had promised a pension of ten thousand maravedis to him who should first discover land. Martin Alonzo Pinzon crowded all canvas, and as the *Pinta* was a fast sailer he generally kept the lead. In the afternoon he hailed the Admiral and informed him that, from the flight of a great number of birds, and from the appearance of the northern horizon, he thought there was land in that direction.

There was, in fact, a cloudiness in the north, such as often hangs over land; and at sunset it assumed such shapes and masses that many fancied they beheld islands. There was a universal wish, therefore, to steer for that quarter. Columbus, however, was persuaded that they were mere illusions. Every one who has made a sea voyage must have witnessed the deceptions caused by clouds resting upon the horizon, especially about sunset and sunrise; which the eye, assisted by the imagination and desire, easily converts into the wished-for land. This is particularly the case within the tropics, where the clouds at sunset assume the most singular appearances.

On the following day there were drizzling showers, unaccompanied by wind, which Columbus considered favorable signs; two boobies also flew on board the ships, birds which, he observed, seldom fly twenty leagues from land. He sounded, therefore, with a line of two hundred fathoms, but found no bottom. He supposed he might be passing between islands lying to the north and south; but was unwilling to waste the present favoring breeze by going in search for them; besides, he had confidently affirmed that land was to be found by keeping steadfastly to the west; his whole expedition had been founded on such a presumption; he should, therefore, risk all credit and authority with his people were he to appear to doubt and waver, and to go groping blindly from point to point of the compass. He resolved, therefore, to keep one bold course always westward, until he should reach the coast of India; and afterward, if advisable, to seek these islands on his return.

Notwithstanding his precaution to keep the people ignorant of the distance they had sailed, they were now growing extremely uneasy at the length of the voyage. They had advanced much farther west than ever man had sailed before, and though already beyond the reach of succor, still they continued daily leaving vast tracts of ocean behind them, and pressing on-

ward and onward into that apparently boundless abyss. It is true they had been flattered by various indications of land, and still others were occurring; but all mocked them with vain hopes; after being hailed with a transient joy, they passed away, one after another, and the same interminable expanse of sea and sky continued to extend before them. Even the bland and gentle breeze, uniformly aft, was now conjured by their ingenious fears into a cause of alarm; for they began to imagine that the wind, in these seas, might always prevail from the east, and if so, would never permit their return to Spain.

Columbus endeavored to dispel these gloomy presages, sometimes by argument and expostulation, sometimes by awakening fresh hopes and pointing out new signs of land. On the 20th of September the wind veered, with light breezes from the southwest. These, though adverse to their progress, had a cheering effect upon the people, as they proved that the wind did not always prevail from the east. Several birds also visited the ships: three, of a small kind which keep about groves and orchards, came singing in the morning, and flew away again in the evening. Their songs cheered the hearts of the dismayed mariners, who hailed it as the voice of land. The larger fowl, they observed, were strong of wing, and might venture far to

sea; but such small birds were too feeble to fly far, and their singing showed they were not exhausted by their flight.

On the following day there was either a profound calm or light winds from the southwest. The sea, as far as the eye could reach, was covered with weeds; a phenomenon often observed in this part of the ocean, which had sometimes the appearance of a vast inundated meadow. This has been attributed to immense quantities of submarine plants, which grow at the bottom of the sea until ripe, when they are detached by the motion of the waves and currents, and rise to the surface. These fields of weeds were at first regarded with great satisfaction, but at length they became, in many places, so dense and matted as in some degree to impede the sailing of the ships, which must have been under very little headway. The crews now called to mind some tale about the frozen ocean, where ships were said to be sometimes fixed immovable. They endeavored, therefore, to avoid as much as possible these floating masses, lest some disaster of the kind might happen to themselves. Others considered these weeds as proofs that the sea was growing shallower, and began to talk of lurking rocks, and shoals, and treacherous quicksands; and of the danger of running aground, as it were, in the midst of the ocean, where

their vessels might rot and fall to pieces, far out of the track of human aid, and without any shore where the crews might take refuge. They had evidently some confused notion of the ancient story of the sunken island of Atalantis, and feared they were arriving at that part of the ocean where navigation was said to be obstructed by drowned lands and the ruins of an engulfed country.

To dispel these fears the Admiral had frequent recourse to the lead; but though he sounded with a deep-sea line, he found no bottom. The minds of the crew, however, had gradually become diseased. They were full of vague terrors and superstitious fancies; they construed everything into a cause of alarm, and harassed their commander by incessant murmurs.

For three days there was a continuance of light summer airs from the southward and westward, and the sea was as smooth as a mirror. A whale was seen heaving up its huge form at a distance, which Columbus immediately pointed out as a favorable indication, affirming that these fish were generally in the neighborhood of land. The crews, however, became uneasy at the calmness of the weather. They observed that the contrary winds which they experienced were transient and unsteady, and so light as not to ruffle the surface of the sea, which maintained a sluggish calm like a

lake of dead water. Everything differed, they said, in these strange regions from the world to which they had been accustomed. The only winds which prevailed with any constancy and force were from the east, and they had not power to disturb the torpid stillness of the ocean; there was a risk, therefore, either of perishing amidst stagnant and shoreless waters, or of being prevented, by contrary winds, from ever returning to their native country.

Columbus continued with admirable patience to reason with these fancies, observing that the calmness of the sea must undoubtedly be caused by the vicinity of land in the quarter whence the wind blew, which, therefore, had not space sufficient to act upon the surface, and heave up large waves. Terror, however, multiplies and varies the forms of ideal danger a thousand times faster than the most active wisdom can dispel them. The more Columbus argued, the more boisterous became the murmurs of his crew, until on Sunday, the 25th of September, there came on a heavy swell of the sea, unaccompanied by wind. This phenomenon often occurs in the broad ocean; being either the expiring undulations of some past gale, or the movement given to the sea by some distant current of wind; it was, nevertheless, regarded with astonishment by the mariners, and dispelled the imaginary terrors occasioned by the calm.

Columbus, who as usual considered himself under the immediate eye and guardianship of Heaven in this solemn enterprise, intimates in his journal that this swelling of the sea seemed providentially ordered to allay the rising clamors of his crew; comparing it to that which so miraculously aided Moses when conducting the children of Israel out of the captivity of Egypt.

The situation of Columbus was daily becoming more and more critical. In proportion as he approached the regions where he expected to find land, the impatience of his crews augmented. The favorable signs which increased his confidence were derided by them as delusive; and there was danger of their rebelling, and obliging him to turn back when on the point of realizing the object of all his labors. They beheld themselves with dismay still wafted onward, over the boundless wastes of what appeared to them a mere watery desert, surrounding the habitable world. What was to become of them should their provisions fail? Their ships were too weak and defective even for the great voyage they had already made, but if they were still to press forward, adding at every moment to the immense expanse behind them, how should they ever be able to return, having no intervening port where they might victual and refit?

In this way they fed each other's discontents, gathering together in little knots, and fomenting

a mutinous opposition; and when we consider the natural fire of the Spanish temperament and its impatience of control, and that a great part of these men were sailing on compulsion, we cannot wonder that there was imminent danger of their breaking forth into open rebellion and compelling Columbus to turn back. In their secret conferences they exclaimed against him as a desperado, bent, in a mad fantasy, upon doing something extravagant to render himself notorious. What were their sufferings and dangers to one evidently content to sacrifice his own life for the chance of distinction? What obligations bound them to continue on with him; or when were the terms of their agreement to be considered as fulfilled? They had already penetrated unknown seas, untraversed by a sail, far beyond where man had ever before ventured. They had done enough to gain themselves a character for courage and hardihood in undertaking such an enterprise and persisting in it so far. How much farther were they to go in quest of a merely conjectured land? Were they to sail on until they perished, or until all return became impossible? In such case they would be the authors of their own destruction.

On the other hand, should they consult their safety, and turn back before too late, who would blame them? Any complaints made by Columbus would be of no weight; he was a foreigner

without friends or influence; his schemes had been condemned by the learned, and discountenanced by people of all ranks. He had no party to uphold him, and a host of opponents whose pride of opinion would be gratified by his failure. Or, as an effectual means of preventing his complaints, they might throw him into the sea, and give out that he had fallen overboard while busy with his instruments contemplating the stars; a report which no one would have either the inclination or the means to controvert.

Columbus was not ignorant of the mutinous disposition of the crew; but he still maintained a serene and steady countenance, soothing some with gentle words, endeavoring to stimulate the pride or avarice of others, and openly menacing the refractory with signal punishment, should they do anything to impede the voyage.

On the 25th of September the wind again became favorable, and they were able to resume their course directly to the west.

The airs being light, and the sea calm, the vessels sailed near to each other, and Columbus had much conversation with Martin Alonzo Pinzon on the subject of a chart, which the former had sent three days before on board of the *Pinta*. Pinzon thought that, according to the indications of a map, they ought to be in the neighborhood of Cipango and the other islands which the Admiral had therein delineated. Co-

lumbus partly entertained the same idea, but thought it possible that the ships might have been borne out of their track by the prevalent currents, or that they had not come so far as the pilots had reckoned. He desired that the chart might be returned, and Pinzon, tying it to the end of a cord, flung it on board to him. While Columbus, his pilot, and several of his experienced mariners were studying the map, and endeavoring to make out from it their actual position, they heard a shout from the *Pinta*, and looking up, beheld Martin Alonzo Pinzon mounted on the stern of his vessel, crying "Land! land! Señor, I claim my reward!" He pointed at the same time to the southwest, where there was indeed an appearance of land at about twenty-five leagues distance. Upon this Columbus threw himself on his knees and returned thanks to God; and Martin Alonzo repeated the *Gloria in excelsis*, in which he was joined by his own crew and that of the Admiral.

The seamen now mounted to the mast-head or climbed about the rigging, straining their eyes in the direction pointed out. The conviction became so general of land in that quarter, and the joy of the people so ungovernable, that Columbus found it necessary to vary from his usual course, and stand all night to the southwest. The morning light, however, put an end to all their hopes, as to a dream. The fancied land

proved to be nothing but an evening cloud, and had vanished in the night. With dejected heart they once more resumed their western course, from which Columbus would never have varied but in compliance with their clamorous wishes.

For several days they continued on with the same propitious breeze, tranquil sea, and mild, delightful weather. The water was so calm that the sailors amused themselves with swimming about the vessel. Dolphins began to abound, and flying-fish, darting into the air, fell upon the decks. The continued signs diverted the attention of the crews and insensibly beguiled them onward.

On the 1st of October, to the reckoning of the pilot of the Admiral's ship, they had come five hundred and eighty leagues west since leaving the Canary Islands. The reckoning which Columbus showed the crew was five hundred and eighty-four, but the reckoning which he kept privately was seven hundred and seven. On the following day the weeds floated from east to west; and on the third day no birds were to be seen.

The crews now began to fear that they had passed between islands, from one to the other of which the birds had been flying. Columbus had also some doubts of the kind, but refused to alter his westward course. The people again uttered murmurs and menaces; but on the following day

they were visited by such flights of birds, and the various indications of land became so numerous, that from a state of despondency they passed to one of confident expectation.

Eager to obtain the promised pension, the seamen were continually giving the cry of land, on the least appearance of the kind. To put a stop to these false alarms, which produced continual disappointments, Columbus declared that should any one give such notice, and land not be discovered within three days afterward, he should thenceforth forfeit all claim to the reward.

On the evening of the 6th of October Martin Alonzo Pinzon began to lose confidence in their present course, and proposed that they should stand more to the southward. Columbus, however, still persisted in steering directly west. Observing this difference of opinion in a person so important in his squadron as Pinzon, and fearing that chance or design might scatter the ships, he ordered that, should either of the caravels be separated from him, it should stand to the west, and endeavor as soon as possible to join company again; he directed, also, that the vessels should keep near to him at sunrise and sunset, as at these times the state of the atmosphere is most favorable to the discovery of distant land.

On the morning of the 7th of October, at

sunrise, several of the Admiral's crew thought they beheld land in the west, but so indistinctly that no one ventured to proclaim it, lest he should be mistaken, and forfeit all chance of the reward; the *Niña*, however, being a good sailor, pressed forward to ascertain the fact. In a little while a flag was hoisted at her mast-head, and a gun discharged, being the preconcerted signals for land. New joy was awakened throughout the little squadron, and every eye was turned to the west. As they advanced, however, their cloud-built hopes faded away, and before evening the fancied land had again melted into air.

The crews now sank into a degree of dejection proportioned to their recent excitement; but new circumstances occurred to arouse them. Columbus, having observed great flights of small field-birds going toward the southwest, concluded they must be secure of some neighboring land, where they would find food and a resting-place. He knew the importance which these Portuguese voyagers attached to the flight of birds, by following which they had discovered most of their islands. He had now come seven hundred and fifty leagues, the distance at which he had computed to find the Island of Cipango; as there was no appearance of it, he might have missed it through some mistake in the latitude. He determined, therefore, on the evening of the

7th of October, to alter his course to the west-southwest, the direction in which the birds generally flew, and continued that direction for at least two days. After all, it was no great deviation from his main course, and would meet the wishes of the Pinzons, as well as be inspiring to his followers generally.

For three days they stood in this direction, and the farther they went the more frequent and encouraging were the signs of land. Flights of small birds of various colors, some of them such as sing in the fields, came flying about the ships, and then continued toward the southwest, and others were heard also flying by in the night. Tunny fish played about the smooth sea, and a heron, a pelican, and a duck were seen, all bound in the same direction. The herbage which floated by was fresh and green, as if recently from land, and the air, Columbus observes, was sweet and fragrant as April breezes in Seville.

All these, however, were regarded by the crews as so many delusions beguiling them on to destruction; and when on the evening of the third day they beheld the sun go down upon a shoreless ocean, they broke forth into turbulent clamor. They exclaimed against this obstinacy in tempting fate by continuing on into a boundless sea. They insisted upon turning homeward, and abandoning the voyage as hopeless.

Columbus endeavored to pacify them by gentle words and promises of large rewards; but finding that they only increased in clamor, he assumed a decided tone. He told them it was useless to murmur; the expedition had been sent by the sovereigns to seek the Indies and, happen what might, he was determined to persevere, until, by the blessing of God, he should accomplish the enterprise.

Columbus was now at open defiance with his crew, and his situation became desperate. Fortunately the manifestations of the vicinity of land were such on the following day as no longer to admit a doubt. Besides a quantity of fresh weeds, such as grow in rivers, they saw a green fish of a kind which keeps about rocks; then a branch of thorn with berries on it, and recently separated from the tree, floated by them; then they picked up a reed, a small board, and, above all, a staff artificially carved. All gloom and mutiny now gave way to sanguine expectation; and throughout the day each one was eagerly on the watch, in hopes of being the first one to discover the long-sought-for land.

In the evening, when, according to invariable custom on board the Admiral's ship, the mariners had sung the *Salve Regina*, or vesper hymn to the Virgin, he made an impressive address to his crew. He pointed out the goodness of

God in thus conducting them by soft and favoring breezes across a tranquil ocean, cheering their hopes continually with fresh signs, increasing as their fears augmented, and thus leading and guiding them to a promised land. He now reminded them of the orders he had given on leaving the Canaries, that, after sailing westward seven hundred leagues, they should not make sail after midnight. Present appearances authorized such a precaution. He thought it probable they would make land that very night; he ordered, therefore, a vigilant lookout to be kept from the forecabin, promising to whosoever should make the discovery a doublet of velvet in addition to the pension to be given by the sovereigns.

The breeze had been fresh all day, with more sea than usual, and they had made great progress. At sunset they had stood again to the west, and were ploughing the waves at a rapid rate, the *Pinta* keeping the lead, from her superior sailing. The greatest animation prevailed throughout the ships; not an eye was closed that night. As the evening darkened Columbus took his station on the top of the castle or cabin on the high poop of his vessel, ranging his eye along the dusky horizon, and maintaining an intense and unremitting watch. About ten o'clock he thought he beheld a light glimmering at a great distance. Fearing his

eager hopes might deceive him, he called to Pedro Gutierrez, gentleman of the King's bed-chamber, and inquired whether he saw such a light; the latter replied in the affirmative. Doubtful whether it might not yet be some delusion of the fancy, Columbus called Rodrigo Sanchez of Segovia, and made the same inquiry. By the time the latter had ascended the round-house, the light had disappeared. They saw it once or twice afterward in sudden and passing gleams, as if it were a torch in the bark of a fisherman, rising and sinking with the waves; or in the hand of some person on shore, borne up and down as he walked from house to house. So transient and uncertain were these gleams, that few attached any importance to them; Columbus, however, considered them as certain signs of land, and, moreover, that the land was inhabited.

They continued their course until two in the morning, when a gun from the *Pinta* gave the joyful signal of land. It was first described by a mariner named Rodrigo de Triana; but the reward was afterward adjudged to the Admiral, for having previously perceived the light. The land was now clearly seen about two leagues distant, whereupon they took in sail, and laid to, waiting impatiently for the dawn.

The thoughts and feelings of Columbus in

this little space of time must have been tumultuous and intense. At length, in spite of every difficulty and danger, he had accomplished his object. The great mystery of the ocean was revealed; his theory, which had been the scoff of sages, was triumphantly established; he had secured to himself a glory durable as the world itself.

JAMES COOK
(1728-1779)



JAMES COOK

THE BOY WHO RAN AWAY TO SEA

IN THE eighteenth century many an English shopkeeper's apprentice ran away to sea. Many of these stout lads became as fancy led them either "bluff and cheery hearts of oak" or "roaring rakehell bullies." But one did better, and made his humble name illustrious by his discoveries in the South Seas.

Sir Walter Besant tells us, in the following pages, how this came about, and sketches an excellent likeness of his hero:

*The son of a hind of Scotch descent, afterward a stone mason, and of a Yorkshire woman of like position and parentage, James Cook had little backing from his family and his connections. Yet if we were to have chosen an ancestry which in those days would have given a boy the best chance of success, it would have been difficult to choose a better stock on both sides—on the one hand the Scotch patience, intelligence, and industry, and on the other

*From "Captain Cook," by Sir Walter Besant. Macmillan & Co., 1894.

hand the Yorkshire independence and self-reliance. Add to this—a quality especially essential to success in that century of endurance, hard fare, and continual fighting—the power of contenting himself with the simplest life under the hardest conditions. What the common sailor endured with grumbling Captain Cook endured with cheerfulness. This also he owed as much to his parentage as to the habits of early life.

When the boy reached his thirteenth year, and it was time to look about for him, it was resolved to apprentice him to one Sanderson, a shopkeeper of Staithes, or the Staithes. The existence of tombstones in Great Ayton churchyard bearing the name of Sanderson seems to explain why the boy was sent to Mr. Sanderson of Staithes. Perhaps he was in some way connected with the family. Perhaps the Sanderson of Staithes let the Sanderson of Great Ayton know that he was in want of a boy. Certainly the two places were then as far apart and as distinct from each other as York is now from London. In one the population was wholly rural and agricultural, in the other it was wholly seafaring. Between the two villages there lay an expanse more than fifteen miles across. If one wanted a village by the sea, surely Redcar was nearer than Staithes, and Whitby, if one wanted a great

commercial centre, was as near. But the boy was sent to Staithes. He would reach it by whatever path led across the moor, probably through Lofthouse, sacred to the memory of a Loathly Worm. No doubt such an apprenticeship would seem to the simple village folk a chance of a rise in the world for their boy. It was indeed a chance, and the lad seized upon it. Yet not quite as they expected. . . .

He who visits this quaint old Yorkshire town, when he stands upon the far side of the *Cod and Lobster*, upon the wooden pier, may in imagination rebuild a row of houses along the shore exactly similar to those which still stand upon the shore behind him. Such a row actually stood there in the year 1740, and among them was Mr. Sanderson's double shop—the grocery on one side, and the drapery on the other. Under the counter—let us hope that of the latter department, where there would be fewer cockchafers, beetles, and earwigs—slept the apprentice, James Cook. All apprentices slept under the counter in those days. In the morning he swept out the shop, put things in their places—they had not then arrived at dressing the windows; this done, he had his breakfast—a hunch of bread, a lump of fat bacon, and a mug of small ale; this despatched, all day long he fetched, carried, waited, served, and listened to the instructions of Mr.

Sanderson. He also listened, whenever he could get outside the shop, to the talk of the seafaring men on the Staithe. He heard many things strange and wonderful: he heard how the men went forth at night in all weathers to catch the herring and the cod; he heard how some of them had served on colliers and coasters, and so knew all the ports and the humours of each from Whitby to Wapping; how some, again, had gone forth to the Arctic seas in whalers and had met with perils many and various among the ice, the bears, and the great whales; nay, there were some who had been pressed into His Majesty's service, fought His Majesty's battles, and returned home again none the worse for their years afloat—even though their backs bore marks of the captain's discipline.

Now to some boys, when they hear such stories, there falls upon their senses a longing so mighty that it overpowers them. Like the rats when the piper of Hamelin first began, like the children when his flute played a second time, they hear strange voices; they see imaginary splendours, the washing of the waves upon the shore falls upon their ears like the sweetest music; their hearts swell only to see a black collier beating up slowly against the wind; and presently a voice not to be resisted calls upon them to arise and betake themselves

to some place where they, too, can be received upon shipboard and become sailors for good or for evil. Alas! this was generally, in James Cook's time, for evil; the sailor had then things to encounter the like of which we have now well-nigh forgotten; there was scurvy at sea, there were ships too clumsy to answer helm, there were worm-eaten bottoms, there was foul water to drink and not enough of it, salt junk to eat and not enough of that; there were captains who could, and sometimes did, lash the flesh off the seaman's back for a word or a look of mutiny; there were sharks ashore and there was the enemy afloat. Yet nothing—not the warnings of the experienced or the history of terrible shipwrecks, or the certain knowledge of these things—could keep the young sailor ashore or make him prefer the counter to the deck.

James Cook was such a boy. He heard these voices and had these visions. Perhaps among the fisher-folk of the Staithes there may have been one or two who had sailed through the Straitle Maire and up the coast of Chili and Peru and even beyond and north of the Island of California, escaping from the Spanish fleet and boldly tackling the biggest and strongest Spanish ship, and so across the great Pacific Ocean, on the parallel of latitude 13° N., to the Isle of Guam, whence, through friendly seas and round the Cape of Good Hope, home. There

came a time when he could resist no longer, and he fled.

Legends have grown up around this Hejira, from which Cook's life should be dated. It is said that he quarrelled with his master; it is said that he demanded to have his articles broken; it is further said, that, in order to pay for a conveyance from the Staithes to Whitby, he stole a shilling from the till. The preservation of the till itself, which was shown until quite recently, has always been considered sufficient proof of this story of the stolen shilling. True is it that on the spot certain of the oldest inhabitants endeavour to soften down the story, to remove from it the more tragic elements—which really constitute its strength, and lend it a moral—by alleging that James Cook did not steal a shilling, but that he exchanged an old for a new shilling, by which his master was in no way injured. Now the mute evidence of the till in no ways supports this explanation. It says plainly: "Either a shilling was stolen from me, or it was not. Looking into the receptacles and the depths of me, what do you think?" . . .

The *Book of Things Forgotten* narrates that the ship in which Cook offered his services was ready for sea; that he was taken on board as ship's boy, and proved himself, during the voyage to London port and home, a lad of quick

parts and great activity, insomuch that the rope's end was seldom required to start him, and the mate, though a choleric person, found it unnecessary to cuff the boy unless he was actually within reach. Further, that this officer interested himself, being of a generous and humane disposition, in the boy, and advised him to get bound to the owners of the ship for a term of years, holding out his own remarkable rise from the position of apprentice to be mate or first lieutenant of the collier. To this rank, he said, the boy might himself reasonably and even laudably aspire, though it was given to few to reach so dizzy an elevation. In short, he persuaded the boy for his own good.

The owners of the ship were two Quaker merchants, brothers, named John and Henry Walker. They lived together, and had their office in the narrow street now named Grape Lane, but then a continuation of Sandgate. Their house, now converted into two, still stands—a plain, Quaker-like house. These worthy gentlemen received the lad as their apprentice, bound to them for three years, with the consent of his father, and perhaps after the former articles with Mr. Sanderson had been torn up and annulled.

The lad served out his time as apprentice first on the *Freelove*, of 450 tons, employed in the coal trade; and afterward in the *Three Brothers*, a

fine new ship of 600 tons, on the rigging and fitting of which he worked while ashore. This vessel was employed for a time as a transport ship. In 1749 she was paid off at Deptford, and then employed in the Norway trade.

While an apprentice, he lodged at his master's house while on shore, and the tradition still survives of his sober and studious conduct during those times.

In the year 1750 he was on board the *Maria* belonging to Mr. John Wilkinson of Whitby, employed in the Baltic trade, under the command of Captain Gaskin. In 1751 he served on board a Stockton ship. In 1752 he was appointed, by Mr. Walker, mate of the *Friendship*, of 400 tons. He was also in the coal trade.

Observe that for three years, when this period of his life came to a close, Cook had been mate, that is, second officer, on board a collier, and that before that time he had been an able seaman in the same trade. A rude training, but the most effective possible. It taught him seamanship thoroughly; it taught him to understand the common sailor, and to feel for him. But it was not, one imagines, a perfect school of manners.

As regards the life led on board the merchant ship, it seems to have been much the same as that in the Royal Navy; the men were perhaps knocked about more and flogged less; there was

little discipline, but much swearing, cuffing, and in case of mutiny the officers had to be ready to fell the mutineers with the first weapon that came handy—a marline-spike, a cutlass, or anything. As for the rations and general living, I suppose they were much the same on a merchantman as on a king's ship, and we shall presently see how the men lived in the Royal Navy in the middle of the eighteenth century. As for the things that the boy would learn, they would be all summed up under the head of practical seamanship; he would learn first all the parts of a ship and her rigging: the sails, the running, and the standing gear, and how to use them; he would learn how to sail a ship, how to steer her, how to save her in time of storm and danger; in the thirteen years that he worked for the Quaker brothers there was plenty of time to acquire a thorough knowledge of seamanship. This period, indeed, proved the foundation of the lad's fortune; he became a sailor. But for book learning I cannot understand how he could acquire any. The captain and the mate would have one or two of the handbooks used by all sailors; readers of this series have heard from Mr. Clark Russell, in his *Life of Dampier*, of a sailor's *Waggoner*, there was also the sailor's *Vade Mecum*, containing all kinds of practical rules and information. Apart from such books, I think there could have been nothing to help

the boy. He preserved, however, the thirst for reading first implanted in him by Mistress Walker at Marton; a boy with an active and curious mind never loses that thirst.

It is also reasonable to suppose, since he was promoted and became mate of his vessel, that his conduct and ability proved satisfactory to his employers; he would probably have received the command of a ship but for the accident which changed the whole current of his life, and enabled him to achieve the glory that belongs to the great navigators of the world.

Early in the year 1755, though the country was then nominally at peace with France, it was felt necessary for the protection of the colonies to send a fleet to the American station, with orders to attack any French squadron which might be found in those waters, where it was assumed that they could be sailing with none other than hostile intentions. These instructions were given openly, and were communicated to the French Court by the ambassador. The king replied that the firing of the first shot would be regarded as a declaration of war.

That shot was fired on the 6th of June, but war was not formally declared before May 17th in the following year. . . .

The imminent war caused a press, both hot and heavy, in every part of the United Kingdom. Nowhere was it so hot as in the port of London,

with its thousand ships and its tens of thousands of sailors. At this moment Cook's vessel, the *Friendship* of Whitby, was lying in the river. Although he was now a mate on board, he was by no means free of the pressgang, nor would his position on board a collier help him to any rating on board a man-of-war above that of able seaman. There was a way, however, better than that of being pressed; it was to enter as a volunteer. It must be remembered that the service was not then governed by the same rigid rules as now prevail. A man might, and sometimes did, obtain a commission in the navy without going through the preliminary and lower ranks. The branch in which a man with a practical knowledge of seamanship might reasonably hope to rise was that of master's mate first and master afterward. Also, it was not the branch in which he would have to encounter aristocratic influence and favouritism. Young gentlemen who entered the navy had no desire to become masters. Those who went into this line were practical sailors, men as tough and often as rough as the common seamen, who lived, when they were at home, at Wapping, Popular, Shadwell, and Stepping, if they belonged to the port of London; or at Point, Gosport, and certain streets outside the dockyard walls at Portsmouth if they belonged to that town. Cook, at that time twenty-seven years of age, resolved that he would not

be a pressed man. He would enter as a volunteer. Accordingly he repaired to a rendezvous at Wapping, where he entered as an able seaman on board the *Eagle*, sixty guns, Captain John Hamer.

In the year 1759 Cook was promoted to the rank of master, and appointed to the *Grampus* sloop, May 10th. When it was found that the former master of the *Grampus* had returned to his ship, Cook's appointment was transferred to the *Garland*. It was discovered that the *Garland* had already sailed. Cook was then appointed to the *Mercury*. So far, then, this young man had done pretty well. To rise from a collier's apprentice to be master, not master's mate, but full master, on board a king's ship by the age of thirty must be considered creditable indeed. No doubt at the time Cook thought he had touched the highest point.

We may now consider how far advanced he was at this time in scientific attainment. His practical seamanship recommended him for promotion. What was it that recommended him for the services he was immediately to perform? Kippis tells the story in words which there is no need to alter:

"The destination of the *Mercury* was to North America, where she joined the fleet under the command of Sir Charles Saunders, which, in conjunction with the land forces

under General Wolfe, was engaged in the famous siege of Quebec. During that siege a dangerous and difficult service was necessary to be performed. This was to take the soundings in the channel of the River St. Lawrence, between the Island of Orleans and the north shore, directly in the front of the French fortified camp at Montmorency and Beauport, in order to enable the admiral to place ships against the enemy's batteries, and to cover our army in a general attack which the heroic Wolfe intended to make on the camp. Captain Palliser, in consequence of his acquaintance with Mr. Cook's sagacity and resolution, recommended him to the service, and he performed it in the most complete manner. In this business he was employed during the night time for several nights together. At length he was discovered by the enemy, who collected a great number of Indians and canoes in a wood near the waterside, which were launched in the night for the purpose of surrounding him and cutting him off. On this occasion he had a very narrow escape. He was obliged to run for it, and pushed on shore on the Island of Orleans, near the guard of the English hospital. Some of the Indians entered at the stern of the boat as Mr. Cook leaped out at the bow; and the boat, which was a barge belonging to one of the ships of

war, was carried away in triumph. However, he furnished the admiral with as correct and complete a draught of the channel and soundings as could have been made after our countrymen were in possession of Quebec. Sir Hugh Palliser has good reason to believe that before this time Mr. Cook had scarcely ever used a pencil, and that he knew nothing of drawing. But such was his capacity that he speedily made himself master of every object to which he applied his attention.

"Another important service was performed by Mr. Cook while the fleet continued in the River St. Lawrence. The navigation of that river is exceedingly difficult and hazardous. It was particularly so to the English, who were then in a great measure strangers to this part of North America, and who had no chart on the correctness of which they could depend. It was, therefore, ordered by the admiral, that Mr. Cook should be employed to survey those parts of the river below Quebec which navigators had experienced to be attended with peculiar difficulty and danger, and he executed the business with the same diligence and skill of which he had already afforded so happy a specimen. When he had finished the undertaking, his chart of the River St. Lawrence was published, with soundings and directions for sailing in that river. Of the accuracy and

utility of this chart it is sufficient to say that it hath never since been found necessary to publish any other. One which has appeared in France is only a copy of the author's on a reduced scale."

Such were the services which he performed within a few weeks after his appointment as master. It is clear that such work would never have been entrusted to a young man who possessed no other qualifications than the knowledge of handling a ship. One does not generally step all at once from the rank of able seaman to the preparation of a most important chart and the examination of a difficult seaway. Nor were Cook's previous services the only reason why he should be selected from all the officers of the fleet for the important duty. Special knowledge, as well as special aptitude, must have been understood.

These considerations prove that he already possessed special knowledge. How he acquired it, by whose assistance, who lent him books, how he found time or opportunity, it is impossible to learn. Most of this knowledge must have been learned during the four years in the Royal Navy. It must, however, be noted that there is no other case on record in which a sailor boy starting in the very lowest place with the humblest origin and the very smallest outfit of learning has so far succeeded

as to be promoted at thirty to the rank of master in the king's navy, and immediately afterward to be selected for the performance of a piece of work requiring great technical knowledge, and—one would think—considerable experience. . . .

The portraits of naval worthies are sometimes disappointing—the faces of some gallant admirals have even, if one may respectfully use the word, a fatuous expression, no doubt the fault of the rascal painter. That of James Cook satisfies. It is a face worthy of the navigator. Such was the appearance of the man: tall, thin, grave, even austere. As for his personal habits, he was, as all agree, of robust constitution, inured to labour, and capable of undergoing the severest hardships. Every northeasterly gale that buffeted the collier's boy in the German Ocean, every night spent in battling with the winter gales between Newcastle and the port of London, helped to build up this strength and endurance. He was able to eat without difficulty the coarsest and the most ungrateful food—on what luxuries are even the mates of a collier nourished? "Great was the indifference with which he submitted to every kind of self-denial." A man who felt no hardships, who desired no better fare than was served out to his men, who looked on rough weather as the chief part

of life, who was never sick, and never tired—where was there his like?

And a man who never rested; he was always at work. "During his long and tedious voyages," writes Captain King after his death, "his eagerness and activity were never in the least degree abated. No incidental temptation would detain him for a moment; even those intervals of recreation which sometimes unavoidably occurred, and were looked for by us with a longing that persons who have experienced the fatigues of service will readily excuse, were submitted to by him with a certain impatience whenever they could not be employed in making a further provision for the more effectual prosecution of his designs."

When we have read so far we are not surprised to hear that he was a man of a hasty temper and liable to passion. A man who was never tired, never wanting to sit down and rest, impatient of enforced leisure, careless about luxuries, incessantly at work—how should he be anything but hasty and passionate when he found his plans obstructed by the weakness or the laziness of men? . . .

It seems idle to add anything concerning the character of James Cook to what has gone before. He was hard to endure, true to carry out his mission, perfectly loyal and single-minded, he was fearless, he was hot-tempered

and impatient, he was self-reliant, he asked none of his subordinates for help or for advice, he was temperate, strong, and of simple tastes, he was born to a hard life, and he never murmured however hard things proved. And, like all men born to be great, when he began to rise, with each step he assumed, as if it belonged to him, the dignity of his new rank. A plain man, those who knew him say, but of good manners. If this volume does not show the manner of the man, then it has failed. Such as his achievements required, such he was.

Let us, however, once more repeat briefly what those achievements were, because they were so great and splendid, and because no other sailor has ever so greatly enlarged the borders of the earth. He discovered the Society Islands; he proved New Zealand to be two islands and he surveyed its coasts; he followed the unknown coast of New Holland for two thousand miles and proved that it was separated from New Guinea; he traversed the Antarctic Ocean on three successive voyages, sailing completely around the globe in its high latitudes, and proving that the dream of the great southern continent had no foundation, unless it was close around the Pole and so beyond the reach of ships; he discovered and explored a great part of the coast of New Caledonia, the largest island in the South Pacific next to New

Zealand; he found the desolate Island of Georgia, and Sandwichland, the southernmost land yet known; he discovered the fair and fertile archipelago called the Sandwich Islands; he explored three thousand five hundred miles of the North American coast, and he traversed the icy seas of the North Pacific, as he had done in the south, in search of the passage which he failed to discover. All this, without counting the small islands which he found scattered about the Pacific.

Again, he not only proved the existence of these islands, but he was in advance of his age in the observations and the minute examination which he made into the religion, manners, customs, arts, and language of the natives wherever he went. It was he who directed these inquiries, and he was himself the principal observer. When astronomical observations had to be made it was he who acted as principal astronomer. He was as much awake to the importance of botany, especially of medicinal plants, as he was to the laying down of a correct chart. It is certain that there was not in the whole of the king's navy any officer who could compare with Cook in breadth and depth of knowledge, in forethought, in the power of conceiving great designs, and in courage and pertinacity in carrying them through. Let us always think of the captain growing only more cheerful as his ship forced her way

southward, though his men lay half-starved and half-poisoned on the deck.

His voyages would have been impossible, his discoveries could not have been made, but for that invaluable discovery of his whereby scurvy was kept off and the men enabled to remain at sea long months without a change. I have called attention to the brief mention he makes of privation and hardships; he barely notes the accident by which half his company were poisoned by fish, he says nothing about the men's discomforts when their biscuit was rotten. These things, you see, are not scurvy. One may go hungry for a while, but recover when food is found and is none the worse; one gets sick of salt-junk, but if scurvy is averted, mere disgust is not worth observation. To drive off scurvy—to keep it off—was the greatest boon that any man could confer upon sailors. Cook has the honour and glory of finding out the way to avert this scourge. Those who have read of this horrible disease—the tortures it entailed—the terror it was on all long voyages—will understand how great should be the gratitude of the country to this man. Since the disease fell chiefly upon the men before the mast, it was fitting that one who had also in his youth run up the rigging to the music of the boatswain's pipe should discover that way and confer that boon.

JAMES WATT
(1736-1819)

JAMES WATT

"THE TOKEN OF INFINITE PAINS"

IN WRITING the life of James Watt, Mr. Carnegie found a task very much to his taste. His generous enthusiasm, in describing his fellow-countryman's perseverance under difficulties, is good to see. At times he waxes lyrical. For example, "Did Wallace give up the fight or ever think of giving it up? Never! It was death or victory. Bruce and the spider! Did Bruce falter? Never! Neither would he. "Scots wha hae!" "Let us do or die!"

*The fond mother having lost several of her children born previously was intensely solicitous in her care of James, who was so delicate that regular attendance at school was impossible. The greater part of his school years he was confined most of the time to his room. This threw him during most of his early years into his mother's company and tender care. Happy chance! What teacher, what companionship, to compare with that of such a mother! She taught him to read most of what he then knew,

*From "James Watt," by Andrew Carnegie. Doubleday, Page & Co., 1905.

and, we may be sure, fed him on the poetry and romance upon which she herself had fed, and for which he became noted in after life. He was rated as a backward scholar at school, and his education was considered very much neglected. . . .

Precocious children are said rarely to develop far in later years, but Watt was preëminently a precocious child, and of this several proofs are related. A friend looking at the child of six said to his father: "You ought to send your boy to a public school, and not allow him to trifle away his time at home." "Look how he is occupied before you condemn him," said the father. He was trying to solve a problem in geometry. His mother had taught him drawing and with this he was captivated. A few toys were given him, which were constantly in use. Often he took them to pieces, and out of the parts sometimes constructed new ones, a source of great delight. In this way he employed and amused himself in the many long days during which he was confined to the house by ill health.

It is at this stage the steam-and-kettle story takes its rise. Mrs. Campbell, Watt's cousin and constant companion, recounts, in her memoranda, written in 1798:

Sitting one evening with his aunt, Mrs. Muirhead, at the tea-table, she said: "James Watt, I

never saw such an idle boy; take a book or employ yourself usefully; for the last hour you have not spoken one word, but taken off the lid of that kettle and put it on again, holding now a cup and now a silver spoon over the steam, watching how it rises from the spout, and catching and connecting the drops of hot water it falls into. Are you not ashamed of spending your time in this way?"

To what extent the precocious boy ruminated upon the phenomenon must be left to conjecture. . . .

While Watt was still in boyhood, his wise father not only taught him writing and arithmetic, but also provided a set of small tools for him in the shop among the workmen—a wise and epoch-making gift, for young Watt soon revealed such wonderful manual dexterity, and could do such astonishing things, that the verdict of one of the workmen, "Jamie has a fortune at his finger-ends," became a common saying among them. The most complicated work seemed to come naturally to him. One model after another was produced to the wonder and delight of his older fellow-workmen. Jamie was the pride of the shop, and no doubt of his fond father, who saw with pardonable pride that his promising son inherited his own traits, and gave bright promise of excelling as a skilled handicraftsman.

The mechanical dexterity of the Watts, grandfather, father, and son, is not to be belittled, for most of the mechanical inventions have come from those who have been cunning of hand and have worked as manual laborers, generally in charge of the machinery or devices which they have improved. When new processes have been invented, these also have usually suggested themselves to the able workmen as they experienced the crudeness of existing methods. Indeed, few important inventions have come from those who have not been thus employed. It is with inventors as with poets; few have been born to the purple or with silver spoons in their mouths, and we shall plainly see later on that had it not been for Watt's inherited and acquired manual dexterity, it is probable that the steam engine could never have been perfected, so often did failure of experiments arise solely because it was in that day impossible to find men capable of executing the plans of the inventor. His problem was to teach them by example how to obtain the exact work required when the tools of precision of our day were unknown and the men themselves were only workmen of the crudest kind. Many of the most delicate parts, even of working engines, passed through Watt's own hands, and for most of his experimental devices he had himself to make the models. Never was there an inventor who had such rea-

son to thank fortune that in his youth he had learned to work with his hands. It proved literally true, as his fellow-workmen in the shop predicted, that "Jamie's fortune was at his finger-ends."

As before stated, he proved a backward scholar for a time at the grammar school. No one seems to have divined the latent powers smouldering within. Latin and Greek classics moved him not, for his mind was stored with more entrancing classics learned at his mother's knee; his heroes were of nobler mould than the Greek demigods, and the story of his own romantic land more fruitful than that of any other of the past. . . .

"Happy is the man who has found his work," says Carlyle. Watt found his when yet a boy at school. Thereafter never a doubt existed as to the field of his labors. The choice of an occupation is a serious matter with most young men. There was never room for any question of choice with young Watt. The occupation had chosen him, as is the case with genius. "Talent does what it can, genius what it must." When the goddess lays her hand upon a mortal dedicated to her shrine, concentration is the inevitable result; there is no room for anything which does not contribute to her service, or rather all things are made contributory to it, and nothing that the devotee sees or reads, hears

or feels, but some way or other is made to yield sustenance for the one great, overmastering task. "The gods send thread for a web begun," because the web absorbs everything that comes within reach. So it proved with Watt.

At fifteen he had twice carefully read "The Elements of Philosophy" (Gravesend), and had made numerous chemical experiments, repeating them again and again, until satisfied of their accuracy. A small electrical machine was one of his productions with which he startled his companions. Visits to his uncle Muirhead at Glasgow were frequent, and here he formed acquaintance with several educated young men, who appreciated his abilities and kindly nature; but the visits to the same kind uncle "on the bonnie, bonnie banks o' Loch Lomond," where the summer months were spent, gave the youth his happiest days. Indefatigable in habits of observation and research, and devoted to the lonely hills, he extended his knowledge by long excursions, adding to his botanical and mineral treasures. Freely entering the cottages of the people, he spent hours learning their traditions, superstitions, ballads, and all the Celtic lore. He loved nature in her wildest moods, and was a true child of the mist, brimful of poetry and romance, which he was ever ready to shower upon his friends. An omniverous reader, in after life he vindicated his practice of reading

every book he found, alleging that he had "never yet read a book or conversed with a companion without gaining information, instruction, or amusement." Scott has left on record that he never had met and conversed with a man who could not tell him something he did not know. Watt seems to have resembled Sir Walter, "who spoke to every man he met as if he were a brother"—as indeed he was—one of the many fine traits of that noble, wholesome character. These two foremost Scots, each supreme in his sphere, seem to have had many social traits in common, and both that fine faculty of attracting others.

The only "sport" of the youth was angling, "the most fitting practice for quiet men and lovers of peace," the "Brothers of the Angle," according to Izaak Walton, "being mostly men of mild and gentle disposition." From the rude, athletic games of the school he was debarred, not being robust, and this was a constant source of morbid misery to him, entailing as it did separation from the other boys. The prosecution of his favorite geometry now occupied his thoughts and time, and astronomy also became a fascinating study. Long hours were often spent, lying on his back in a grove near his home, studying the stars by night and the clouds by day. . . .

Watt now reached his seventeenth year.

His father's affairs were greatly embarrassed. It was clearly seen that the two brothers, John and James, had to rely for their support upon their own unaided efforts. John, the elder, some time before this had taken to the sea and been shipwrecked; leaving only James at home. Of course, there was no question as to the career he would adopt. His fortune "lay at his finger-ends," and accordingly he resolved at once to qualify himself for the trade of a mathematical instrument maker, the career which led him directly in the pathway of mathematics and mechanical science, and enabled him to gratify his unquenchable thirst for knowledge thereof.

Naturally Glasgow was decided upon as the proper place in which to begin, and Watt took up his abode there with his maternal relatives, the Muirheads, carrying his tools with him.

No mathematical instrument maker was to be found in Glasgow, but Watt entered the service of a kind of jack-of-all-trades, who called himself an "optician" and sold and mended spectacles, repaired fiddles, tuned spinets, made fishing-rods and tackle, etc. Watt, as a devoted brother of the angle, was an adept at dressing trout and salmon flies, and handy at so many things that he proved most useful to his employer, but there was nothing to be learned by the ambitious youth.

His most intimate school-fellow was Andrew Anderson, whose elder brother, John Anderson, was the well-known professor of natural philosophy, the first to open classes for the instruction of workingmen in its principles. He bequeathed his property to found an institution for this purpose, which is now a college of the university. The professor came to know young Watt through his brother, and Watt became a frequent visitor at his house. He was given unrestricted access to the professor's valuable library, in which he spent many of his evenings. . . .

Through Professor Muirhead, a kinsman of Watt's mother, he was introduced to many others of the faculty of the university, and, as usual, attracted their attention, especially that of Doctor Dick, professor of natural philosophy, who strongly advised him to proceed to London, where he could receive better instruction than it was possible to obtain in Scotland at that time. The kind professor, diviner of latent genius, went so far as to give him a personal introduction, which proved efficient. How true it is that the worthy, aspiring youth rarely goes unrecognized or unaided. Men with kind hearts, wise heads, and influence strong to aid, stand ready at every turn to take modest merit by the hand and give it the only aid needed, opportunity to speak,

through results, for itself. So London was determined upon. Fortunately, a distant relative of the Watt family, a sea captain, was about to set forth upon that then long and toilsome journey. They started from Glasgow June 7, 1755, on horseback, the journey taking twelve days. . . .

Watt arrived in London, a stranger in a strange land, unknowing and unknown. But the fates had been kind, for, burdened with neither wealth nor rank, this poor would-be skilled mechanic was to have a fair chance by beginning at the bottom among his fellows, the sternest yet finest of all schools to call forth and strengthen inherent qualities, and impel a poor young man to put forth his utmost effort when launched upon the sea of life, where he must either sink or swim, no bladders being in reserve for him.

Our young hero rose to the occasion and soon proved that, Cæsar-like, he could "stem the waves with heart of controversy." Thus the rude school of experience calls forth and strengthens the latent qualities of youth, implants others, and forms the indomitable man, fit to endure and overcome. Here, for the first time, alone in swarming London, not one relative, not one friend, not even an acquaintance, except the kind sea captain, challenged by the cold world around to do or die, fate

called to Watt as it calls to every man who has his own way to make:

“This is Collingtogle ford,
And thou must keep thee with thy sword.”

When the revelation first rushes upon a youth, hitherto directed by his parents, that, boy no more, he must act for himself, presto! change! he is a man, he has at last found himself. The supreme test, which proves the man, can come in all its winnowing force only to those born to earn their own support by training themselves to be able to render to society services which command return. This training compels the development of powers which otherwise would probably lie dormant. Scotch boy as Watt was to the core, with the lowland broad, soft accent, and ignorant of foreign literature, it is very certain that he then found support in the lessons instilled at his mother's knee. He had been fed on Wallace and Bruce, and when things looked darkest, even in very early years, his national hero, Wallace, came to mind, and his struggles against fearful odds, not for selfish ends, but for his country's independence. Did Wallace give up the fight, or ever think of giving up? Never! It was death or victory. Bruce and the spider! Did Bruce falter? Never! Neither would he. “Scots wha hae!” “Let us do or

die!" implanted before his teens, has pulled many a Scottish boy through the crises of life when all was dark, as it will pull others yet to come. Although Burns and Scott had yet to appear, to crystallize Scotland's characteristics and plant the talismanic words into the hearts of young Scots, Watt had a copious supply of the national sentiment, to give him the "stout heart for the stye brae," when manhood arrived. His mother had planted deep in him and nurtured precious seed from her Celtic garden, which was sure to grow and bear good fruit.

We are often met with the question, "What is the best possible safeguard for a young man, who goes forth from a pure home, to meet the temptations that beset his path?" Various answers are given, but, speaking as a Scot, reared as Watt was, the writer believes all the suggested safeguards combined scarcely weigh as much as preventives against disgracing himself as the thought that it would not be only himself he would disgrace, but that he would also bring disgrace upon his family, and would cause father, mother, sister, and brother to hang their heads among their neighbors in secluded village, on far-away moor, or in lonely glen. The Scotch have strong traces of the Chinese and Japanese religious devotion to "the family," and the filial instinct is intensely

strong. The fall of one member is the disgrace of all. Even although Watt's mother had passed, there remained the venerated father in Greenock, and the letters regularly written to him, some of which have fortunately been preserved, abundantly prove that, though far from home, yet in home and family ties and family duties the young man had his strong tower of defense, keeping him from "all sense of sin or shame." Watt never gave his father reason for one anxious thought that he would in any respect discredit the good name of his forebears.

Many London shops were visited, but the rules of the trade, requiring apprentices to serve for seven years, or, being journeymen, to have served that time, proved an insuperable obstacle to Watt's being employed. His plan was to fit himself by a year's steady work for return to Glasgow, there to begin on his own account. He had not seven years to spend learning what he could learn in one. He would be his own master. Wise young man in this he was. There is not much outcome in the youth who does not already see himself captain in his dreams, and steers his barque accordingly, true to the course already laid down, not to be departed from, under any stress of weather. We see the kind of stuff this young Scotch lad was made of in the tenacity with

which he held to his plan. At last some specimens of his work having seemed very remarkable to Mr. John Morgan, mathematical instrument maker, Finch Lane, Cornhill, he agreed to give the conquering young man the desired year's instructions for his services and a premium of twenty pounds, whereupon the plucky fellow who had kept to his course and made port wrote to his father of his success, praising his master "as being of as good character, both for accuracy, in his business, and good morals, as any of his way in London." The order in which this aspiring young man of the world records the virtues will not be overlooked. He then adds: "If it had not been for Mr. Short, I could not have got a man in London that would have undertaken to teach me, as I now find there are not above five or six who could have taught me all I wanted."

Mr. Short was the gentleman to whom Professor Dick's letter of introduction was addressed, who, no more than the Professor himself, nor Mr. Morgan, could withstand the extraordinary youth, whom he could not refuse taking into his service—glad to get him, no doubt, and delighted that he was privileged to instruct one so likely to redound to his credit in after years. Thus Watt made his start in London, the twenty pounds premium being duly remitted from home.

Up to this time Watt had been a charge of his father, but it was very small, for he lived in the most frugal style, at a cost of only two dollars per week. In one of his letters to his father he regrets being unable to reduce it below that, knowing that his father's affairs were not prosperous. He, however, was able to obtain some remunerative work on his own account, which he did after his day's task was over, and soon made his position secure as a workman. . . .

Before his year was finished he wrote his father that he had made "a brass sector with a French joint, which is reckoned as nice a piece of framing-work as is in the trade. . . ."

It is highly probable that this first tool finished by his own hands brought to Watt more unalloyed pleasure than any of his greater triumphs of later years, just as the first week's wages of youth, money earned by service rendered, proclaiming coming manhood, brings with it a thrill and glow of proud satisfaction, compared with which all the millions of later years are as dross. . . .

Enforced confinement and unremitting labor soon told upon Watt's delicate constitution, yet he persevered with the self-imposed extra work, which brought in a little honest money and reduced the remittances from home. He caught a severe cold during the winter and was

afflicted by a racking cough and severe rheumatic pains. With his father's sanction, he decided to return home to recuperate, taking good care, however, forehanded as he always proved himself, to secure some new and valuable tools and a stock of materials to make many others, which "he knew he must make himself." A few valuable books were not forgotten, among them Bion's work on the "Construction and Use of Mathematical Instruments"—nothing pertaining to his craft but he would know. King he would be in that, so everything was made to revolve around it. That was the foundation upon which he had to build. To the old home in Scotland our hero's face was now turned in the autumn of 1756, his twentieth year. His native air, best medicine of all for the invalid exile, soon restored his health, and to Glasgow he then went, in pursuance of his plan of life early laid down, to begin business on his own account. He thus became master before he was man. There was not in all Scotland a mathematical instrument maker, and here was one of the very best begging permission to establish himself in Glasgow. As in London so in Glasgow, however, the rules of the Guild of Hammermen, to which it was decided a mathematical instrument maker would belong, if one of such high calling made his appearance, prevented Watt

from entrance if he had not consumed seven years in learning the trade. He had mastered it in one, and was ready to demonstrate his ability to excel by any kind of test proposed. Watt had entered in properly by the door of knowledge and experience of the craft, the only door through which entrance was possible, but he had travelled too quickly; besides, he was "neither the son of a burgess nor had he served an apprenticeship in the borough," and this was conclusive. How the world has travelled onward since those days! and yet our day is likely to be in as great contrast a hundred and fifty years hence. Protective tariffs between nations, and probably wars, may then seem as strangely absurd as the hammermen's rules. Even in 1905 we have still a far road to travel.

Failing in his efforts to establish himself in business, he asked the guild to permit him to rent and use a small workshop to make experiments, but even this was refused. We are disposed to wonder at this, but it was in strict accordance with the spirit of the times.

When the sky was darkest the clouds broke and revealed the university as his guardian angel. Doctor Dick, professor of natural philosophy, knowing of Watt's skill from his first start in Glasgow, had already employed him to repair some mathematical instruments be-

queathed to the university by a Scotch gentleman in the West Indies, and the work had been well done, at a cost of five pounds—the first contract money ever earned by Watt in Glasgow. Good work always tells. Ability cannot be kept down forever; if crushed to earth, it rises again. So Watt's "good work" brought the professors to his aid, several of whom he had met and impressed most favorably during its progress. The university charter, gift of the Pope in 1451, gave absolute authority within the area of its buildings, and the professors resolved to give our hero shelter there—the best day's work they ever did. May they ever be remembered for this with feelings of deepest gratitude. . . .

A room was assigned to Watt, only about twenty feet square, but it served him as it has done others since for great work. When the well-known author, Doctor Smiles, visited the room, he found in it the galvanic apparatus employed by Professor Thompson (Lord Kelvin) for perfecting his delicate invention which rendered ocean cables effective.

The kind and wise professors did not stop here. They went pretty far, one cannot but think, when they took the next step in Watt's behalf, giving him a small room, which could be made accessible to the public, and this he was at liberty to open as a shop for the sale of

his instruments, for Watt had to make a living by his handiwork. Strange work this for a university, especially in those days; but our readers, we are sure, will heartily approve the last, as they have no doubt approved the first, action of the faculty in favor of struggling genius. Business was not prosperous at first with Watt, his instruments proving slow of sale. Of quadrants he could make three per week with the help of a lad, at a profit of forty shillings, but as sea-going ships could not then reach Glasgow, few could be sold. A supply was sent to Greenock, then the port of Glasgow, and sold by his father. He was reduced, as the greatest artists have often been, to the necessity of making what are known as "pot-boilers." Following the example of his first master in Glasgow he made spectacles, fiddles, flutes, guitars, and, of course, flies and fishing-tackle, and, as the record tells, "many dislocated violins, fractured guitars, fiddles also, if intreated, did he mend with good approbation." Such were his "pot-boilers" that met the situation.

His friend, Professor Black, who, like Professor Dick, had known of Watt's talent, one day asked him if he couldn't make an organ for him. By this time Watt's reputation had begun to spread, and it finally carried him to the height of passing among his associates as

"one who knew most things and could make anything." Watt knew nothing about organs, but he immediately undertook the work (1762), and the result was an indisputable success, that led to his constructing, for a mason's lodge in Glasgow, a larger "finger organ, which elicited the surprise and admiration of musicians." This extraordinary man improved everything he touched. For his second organ he devised a number of novelties, a sustained monochord, indicators and regulators of the blast, means for tuning to any system, contrivances for improving the stops, etc.

Lest we are led into a sad mistake here, let us stop a moment to consider how Watt so easily accomplished wonders, as if by inspiration. In all history it may be doubted whether success can be traced more clearly to long and careful preparation than in Watt's case. When we investigate, for instance, this seeming sleight-of-hand triumph with the organs, we find that upon agreeing to make the first, Watt immediately devoted himself to a study of the laws of harmony, making science supplement his lack of the musical ear. As usual, the study was exhaustive. Of course he found and took for guide the highest authority, a profound but obscure book by Professor Smith of Cambridge University, and, mark this, he first made a model of the forthcoming organ. It is safe

to say that there was not then a man in Britain who knew more of the science of music and was more thoroughly prepared to excel in the art of making organs than the new organ-builder.

When he attacked the problem of steam, as we shall soon see, the same course was followed, although it involved the mastering of three languages, that he should miss nothing.

We note that the taking of infinite pains, this forearming of himself, this knowing of everything that was to be known, the note of thorough preparation in Watt's career, is ever conspicuous. The best proof that he was a man of true genius is that he first made himself master of all knowledge bearing upon his tasks. . . .

The supreme hour of Watt's life was now about to strike. He had become deeply interested in the subject of steam, to which Professor Robison had called his attention, Robison being then in his twentieth year, Watt three years older.

Robison's idea was that steam might be applied to wheel carriages. Watt admitted his ignorance of steam then. Nevertheless, he made a model of a wheel carriage with two cylinders of tin plate, but being slightly and inaccurately made, it failed to work satisfactorily. Nothing more was heard of it. Robison soon thereafter left Glasgow. The demon

Steam continued to haunt Watt. He, who up to this time had never seen even a model of a steam engine, strangely discovered in his researches that the university actually owned a model of the latest type, the Newcomen engine, which had been purchased for the use of the natural philosophy class. One wonders how many of the universities in Britain had been so progressive. That of Glasgow seems to have recognized at an early day the importance of science, in which department she continues famous. The coveted and now historical model had been sent to London for repairs. Watt urged its prompt return, and a sum of money was voted for this purpose. Watt was at last completely absorbed in the subject of steam. He read all that had been written on the subject. Most of the valuable matter those days was in French and Italian, of which there were no translations. Watt promptly began to acquire these languages, that he might know all that was to be known. He could not await the coming of the model, which did not arrive until 1763, and began his own experiments in 1761. How did he obtain the necessary appliances and apparatus, one asks. The answer is easy. He made them. Apothecaries' vials were his steam boilers, and hollowed-out canes his steam pipes. Numerous experiments followed and much was learnt. Watt's account

of these is appended to the article on "Steam and the Steam Engine" in the "Encyclopædia Britannica," ninth edition.

Detailed accounts of Watt's numerous experiments, failures, difficulties, disappointments, and successes, as one after the other obstacles were surmounted, is not within the scope of this volume, these being all easily accessible to the student, but the general reader may be interested in the most important of all the triumphs of the indefatigable worker—the keystone of the arch. The Newcomen model arrived at last and was promptly repaired, but was not successful when put in operation. Steam enough could not be obtained, although the boiler seemed of ample capacity. The fire was urged by blowing and more steam generated and still it would not work; a few strokes of the piston and the engine stopped. Smiles says that exactly at the point when ordinary experimentalists would have abandoned the task, Watt became thoroughly aroused. "Every obstacle," says Professor Robison, "was to him the beginning of a new and serious study, and I knew he would not quit it until he had either discovered its worthlessness or had made something of it." The difficulty here was serious. Books were searched in vain. No one had touched it. A course of independent experiments was essential, and upon this he entered

as usual, determined to find truth at the bottom of the well and to get there in his own way. Here he came upon the fact which led him to the stupendous result. The fact was the existence of latent heat, the original discoverer of which was Watt's intimate friend, Professor Black. Watt found that water converted into steam heated five times its own weight of water to steam heat. He says:

"Being struck with this remarkable fact (effect of latent heat), and not understanding the reason of it, I mentioned it to my friend, Doctor Black, who then explained to me his doctrine of latent heat, which he had taught some time before this period (1764); but having myself been occupied with the pursuits of business, if I had heard of it I had not attended to it, when I thus stumbled upon one of the material facts by which that beautiful theory is supported. . . ."

Latent heat was a find indeed, but there remained another discovery yet to make. Watt found that no less than four fifths of all the steam used was lost in heating the cold cylinder, and only one fifth performed service by acting on the piston. Prevent this, and the power of the giant is increased fourfold. Here was the prize to contend for. Win this and the campaign is won. First, then, what caused the loss? This was soon determined. The cylinder was neces-

sarily cooled at the top because it was open to the air, and also cooled below in condensing the charge of steam that had driven the piston up in order to create a vacuum, without which the piston would not descend from top to bottom, to begin another upward stroke. A jet of cold water was introduced to effect this. How to surmount this seemingly insuperable obstacle was the problem that kept Watt long in profound study.

Many plans were entertained, only to be finally rejected. At last the flash came into that teeming brain like a stroke of lightning. Eureka! he had found it. Not one scintilla of doubt ever intruded thereafter. The solution lay right there and he would invent the needed appliances. His mode of procedure, when on the trail of big game, is beautifully illustrated here. When he found the root of the defect which rendered the Newcomen engine impractical for general purposes, he promptly formulated the one indispensable condition which alone met the problem, and which the successful steam engine must possess. He abandoned all else for the time as superfluous, since this was the key of the position. This is the law he then laid down as an axiom—which is repeated in his specification for his first patent in 1769: "To make a perfect steam engine it was necessary that the cylinder should be always as hot as the

steam which entered it, and that the steam should be cooled below 100° to exert its full powers."

Watt describes how at last the idea of the "separate condenser," the complete cure, flashed suddenly upon his mind:

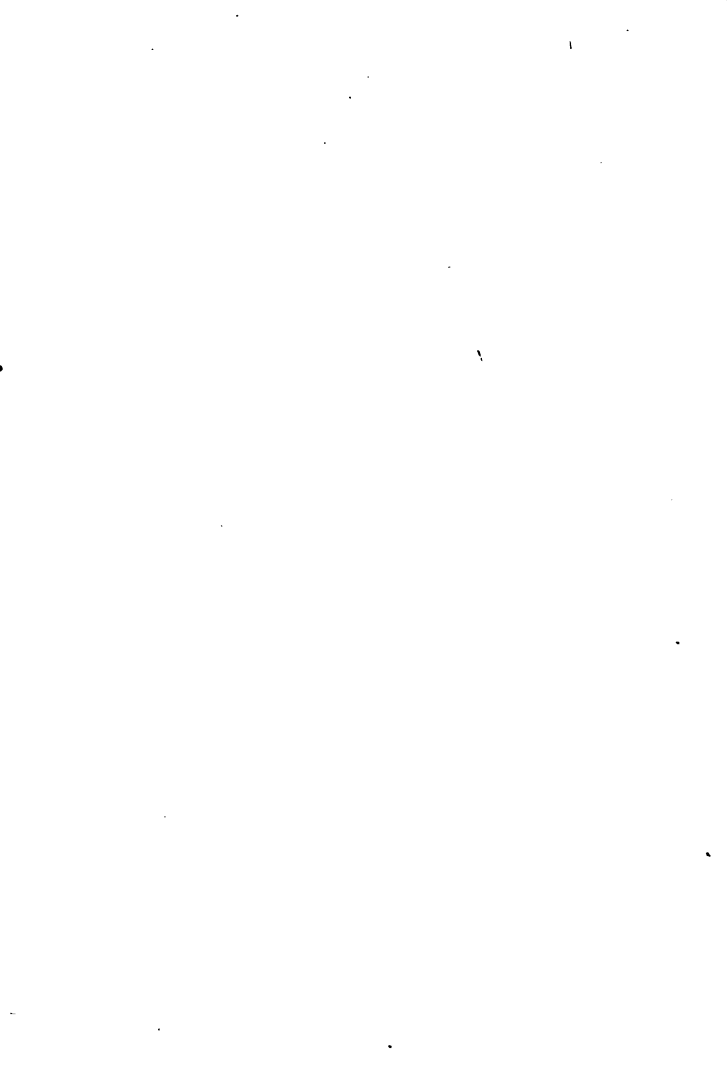
"I had gone to take a walk on a fine Sabbath afternoon, early in 1756. I had entered the green by the gate at the foot of Charlotte Street and had passed the old washing-house. I was thinking upon the engine at the time, and had gone as far as the herd's house, when the idea came into my mind that as steam was an elastic body it would rush into a vacuum, and if a communication were made between the cylinder and an exhausted vessel it would rush into it, and might be there condensed without cooling the cylinder. I then saw that I must get rid of the condensed steam and injection water if I used a jet as in Newcomen's engine. Two ways of doing this occurred to me: first, the water might be run off by a descending pipe, if an outlet could be got at the depth of thirty-five or thirty-six feet, and any air might be extracted by a small pump; the second was to make the pump large enough to extract both water and air. . . . I had not walked farther than the golf house when the whole thing was arranged in my mind."

Professor Black says: "This capital improve-

ment flashed upon his mind at once and filled him with rapture." We may imagine:

"Then felt he like some watcher of the skies
When a new planet sweeps into his ken."

A new world had sprung forth in Watt's brain, for nothing less than the steam engine given to man.



ELIAS HOWE
(1819-1867)

ELIAS HOWE

PER ASPERA AD ASTRA

SUCCESSFUL men do not always lead happy lives.

Elias Howe's story is one of the pitiful incidents in the annals of self-help. Like most inventors, he found he must fight not one but many battles. After years of interrupted experimentation he discovered how to make a sewing machine. But the winning of recognition for his discovery was a greater and more disheartening struggle. And during all these years he was obliged to fight continually, but unavailingly, to keep the wolf from the door of his home. Success came at last in ample measure, but to a meaner soul it must have seemed a mockery, for it found a man broken in health and bereft of the faithful helpmate who had died some time before, worn out by the privations which the inventor's wife is so often called upon to suffer.

*Elias Howe was born in the town of Spencer,

*From "Great Fortunes," by James D. McCabe, Jr. George Maclean, 1870.

Massachusetts, in 1819. He was one of eight children, and it was no small undertaking on the part of his father to provide a maintenance for such a household. Mr. Howe, senior, was a farmer and miller, and, as was the custom at that time in the country towns of New England, carried on in his family some of those minor branches of industry suited to the capacity of children with which New England abounds. When Elias was six years old he was set, with his brothers and sisters, to sticking wire teeth through the leather straps used for making cotton cards. When he became old enough he assisted his father in his sawmill and grist-mill, and during the winter months picked up a meagre education at the district school. He has said that it was the rude and imperfect mills of his father that first turned his attention to machinery. He was not fitted for hard work, however, as he was frail in constitution and incapable of bearing much fatigue. Moreover, he inherited a species of lameness which proved a great obstacle to any undertaking on his part, and gave him no little trouble all through life. At the age of eleven he went to live out on the farm of a neighbor, but the labor proving too severe for him, he returned home and resumed his place in his father's mills, where he remained until he was sixteen years old, when he conceived an ardent desire to go to Lowell to seek

his fortune. One of his friends had just returned from that place, and had given him such a wonderful description of the city and its huge mills, that he was eager to go there and see the marvel for himself. Obtaining his father's consent, he went to Lowell, and found employment as a learner in one of the large cotton mills of the city. He remained there two years, when the great financial disaster of 1837 threw him out of employment and compelled him to look for work elsewhere. He obtained a place at Cambridge, in a machine-shop, and was put to work upon the new hemp-carding machinery of Professor Treadwell. His cousin, Nathaniel P. Banks, after governor of Massachusetts, member of Congress, and major-general, worked in the same shop with him, and boarded at the same house. Howe remained in Cambridge only a few months, however, and was then given a place in the machine-shop of Ari Davis, of Boston.

At the age of twenty-one he married. This was a rash step for him, as his health was very delicate, and his earnings were but nine dollars a week. Three children were born to him in quick succession, and he found it no easy task to provide food, shelter, and clothing for his little family. The light-heartedness for which he had formerly been noted entirely deserted him, and he became sad and melancholy. His

health did not improve, and it was with difficulty that he could perform his daily task. His strength was so slight that he would frequently return home from his day's work too much exhausted to eat. He could only go to bed, and in his agony he wished "to lie in bed for ever and ever." Still he worked faithfully and conscientiously, for his wife and children were very dear to him; but he did so with a hopelessness which only those who have tasted the depths of poverty can understand.

About this time he heard it said that the great necessity of the age was a machine for doing sewing. The immense amount of fatigue incurred and the delay in hand-sewing were obvious, and it was conceded by all who thought of the matter at all that the man who could invent a machine which would remove these difficulties would make a fortune; Howe's poverty inclined him to listen to these remarks with great interest. No man needed money more than he, and he was confident that his mechanical skill was of an order which made him as competent as any one else to achieve the task proposed. He set to work to accomplish it, and, as he knew well the dangers which surround an inventor, kept his own counsel. At his daily labor, in all his waking hours, and even in his dreams, he brooded over this invention. He spent many a wakeful night in these meditations, and his health was

far from being benefited by this severe mental application. Success is not easily won in any great undertaking, and Elias Howe found that he had entered upon a task which required the greatest patience, perseverance, energy, and hopefulness. He watched his wife as she sewed, and his first effort was to devise a machine which should do what she was doing. He made a needle pointed at both ends, with the eye in the middle, that should work up and down through the cloth, and carry the thread through at each thrust; but his elaboration of this conception would not work satisfactorily. It was not until 1844, fully a year after he began the attempt to invent the machine, that he came to the conclusion that the movement of a machine need not of necessity be an imitation of the performance of the hand. It was plain to him that there must be another stitch, and that if he could discover it his difficulties would all be ended. A little later he conceived the idea of using two threads, and forming a stitch by the aid of a shuttle and a curved needle with the eye near the point. This was the triumph of his skill. He had now invented a perfect sewing machine, and had discovered the essential principles of every subsequent modification of his conception. Satisfied that he had at length solved the problem, he constructed a rough model of his machine of wood and wire, in Octo-

ber, 1844, and operated it to his perfect satisfaction. His invention is thus described:

“He used a needle and a shuttle of novel construction, and combined them with holding surfaces, feed mechanism and other devices, as they had never before been brought together in one machine. . . . One of the principal features of Mr. Howe’s invention is the combination of a grooved needle, having an eye near its point, and vibrating in the direction of its length, with a side-pointed shuttle for effecting a locked stitch, and forming, with the threads, one on each side of the cloth, a firm and lasting seam not easily ripped. The main action of the machine consists in the interlocking of the loop, made by the thread carried in the point of the needle, through the cloth, with another thread passed through this loop by means of a shuttle entering and leaving it at every stitch. The thread attached to this shuttle remains in the loop and secures the stitch as the needle is withdrawn to be ready to make the next one. At the same time the cloth, held by little projecting pins to the baster plate, is carried along with this by what is called the ‘feed motion’ just the length of a stitch, the distance being readily adjusted for finer or coarser work. . . . The cloth is held in a vertical position in the machine, and the part to be sewed is pressed against the side of the shuttle-race by a presser plate

hinged on its upper edge, and capable of exerting any required pressure on the cloth, according as to the adjusting screw that regulates it is turned. A slot or perforation through the plate, also extended through the side of the shuttle-race near the bottom, admits the passage of the needle; and when this is pushed in the shuttle can still pass freely over it. The shuttle is pushed one way and then the other through its race or trough by picker staves. The thread for the needle is supplied by a bobbin, the movement of which is checked by a friction band, this securing the paper tention, and the slack of the thread is duly taken up by a suitable contrivance for the purpose. Thus, all the essential features of the most approved sewing machine were first found in that of Mr. Howe; and the machines of later date are, in fact, but modifications of it."

At this time he had abandoned his work as a journeyman mechanic, and had removed to his father's house. Mr. Howe, senior, had established in Cambridge a machine-shop for the cutting of strips of palm-leaf used in the manufacture of hats. Elias and his family lived under his father's roof, and in the garret of the house the half-sick inventor put up a lathe, where he did a little work on his own account, and labored on his sewing machine. He was miserably poor, and could scarcely earn enough

to provide food for his family; and, to make matters worse, his father, who was disposed to help him, lost his shop and its contents by fire. Poor Elias was in a most deplorable condition. He had his model in his head, and was fully satisfied of its excellence, but he had not the money to buy the materials needed in making a perfect machine, which would have to be constructed of steel and iron, and without which he could not hope to convince others of its value. His great invention was useless to him without the five hundred dollars which he needed in the construction of a working model.

In this dilemma he applied to a friend, Mr. George Fisher, a coal and wood merchant of Cambridge, who was a man of some means. He explained his invention to him, and succeeded in forming a partnership with him. Fisher agreed to take Howe and his family to board with him while the latter was making the machine, to allow his garret to be used as a workshop, and to advance the five hundred dollars necessary for the purchase of tools and the construction of a model. In return for this he was to receive one half of the patent, if Howe succeeded in patenting his machine. About the 1st of December, 1844, Howe and his family accordingly moved into Fisher's house, and the little workshop was set up in the garret. All that winter he worked on his model. There was

little to delay him in its construction, as the conception was perfectly clear in his mind. He worked all day, and sometimes nearly all night, and, in April, 1845, had his machine so far advanced that he sewed a seam with it. By the middle of May the machine was completed, and in July he sewed with it the seams of two woollen suits, one for himself and the other for Mr. Fisher. The sewing was so well done that it outlasted the cloth.

It has been stated by Professor Renwick and other scientific men that Elias Howe "carried the invention of the sewing machine further on toward its complete and final utility than any other inventor has ever brought a first-rate invention at the first trial. . . ."

Having patented his machine, Howe endeavored to bring it into use. He was full of hope, and had no doubt that it would be adopted at once by those who were so much interested in the saving of labor. He first offered it to the tailors of Boston; but they, while admitting its usefulness, told him it would never be adopted by their trade, as it would ruin them. Considering the number of machines now used by the tailoring interest throughout the world, this assertion seems ridiculous. Other efforts were equally unsuccessful. Every one admitted and praised the ingenuity of the machine, but no one would invest a dollar in it. Fisher became disgusted

and withdrew from his partnership, and Howe and his family moved back to his father's house. Thoroughly disheartened, he abandoned his machine. He then obtained a place as engineer on a railroad, and drove a locomotive until his health entirely broke down.

With the loss of his health, his hopes revived, and he determined to seek in England the victory which he had failed to win here. Unable to go himself, he sent his machine by his brother Amasa, in October, 1846. Upon reaching London, Amasa sought out Mr. William Thomas, of Cheapside, and explained to him his brother's invention. He found Mr. Thomas willing to use the machine in his business, but upon terms more favorable to himself than to the inventor. He offered the sum of twelve hundred and fifty dollars for the machine which Amasa Howe had brought with him, and agreed to pay Elias fifteen dollars per week if he would enter his service, and adapt the machine to his business of umbrella and corset making. As this was his only hope of earning a livelihood, Elias accepted the offer, and, upon his brother's return to the United States, sailed for England. He remained in Mr. Thomas's employ for about eight months, and at the end of that time left him, having found him hard, exacting, and unreasonable.

Meanwhile his sick wife and three children had joined him in London, and he had found it

hard to provide for them on the wages given him by Mr. Thomas; but after being thrown out of employment his condition was desperate indeed. He was in a strange country, without friends or money, and often he and his little family went whole days without food. Their sufferings were very great, but at length Howe was able (probably by assistance from home) to send his family back to his father's house. He himself remained in London, still hoping to bring his machine into use. It was in vain, however, and so, collecting what few household goods he had acquired in England, he shipped them to America, and followed them thither himself in another vessel, pawning his model and patent papers to pay his passage. When he landed in New York he had half a crown in his pocket, and there came to him on the same day a letter telling him that his wife was dying with consumption in Cambridge. He could not go to her at once, as he had no money, and was too feeble to undertake the distance on foot. He was compelled to wait several days until he could obtain the money for his fare to Cambridge, but at length succeeded in reaching that place just in time to see his wife die. In the midst of his grief he received the announcement that the vessel containing the few household goods which he had shipped from England had been lost at sea. It seemed to him that Fate was bent upon destroy-

distinguished of American inventors, not only because of the unusual degree of completeness shown in his first conception of the sewing machine, but because of the great benefits which have sprung from it. It has revolutionized the industry of the world, opened new sources of wealth to enterprise, and lightened the labors of thousands of working people. There is scarcely a community in the civilized world but contains the evidence of his genius, and honors him as the benefactor of the human race.

CHARLES DARWIN
(1809-1882)



CHARLES DARWIN

"THE VERY ORDINARY BOY"

THE name of Charles Darwin will always be written large in the history of science and in the annals of the nineteenth century. Yet—if we are to credit his own candid appraisal of his native endowments—he was a man of very ordinary capacity, as much handicapped by ill-health as he was assisted by the possession of a small independent income.

How did it happen that among multitudes of individuals similarly circumstanced this one alone won for himself an imperishable name?

From his own words we gather that his curiosity—at first an idle one—was easily aroused by the natural objects which surrounded him. Through constant practice he became an acute observer, and through habit he became a tireless student of the subject in hand. As he knew his memory to be untrustworthy he assiduously took notes.

Thus, in a nutshell, Darwin the average man became Darwin the great man in the good old

way: *he was perseveringly, painstakingly industrious.*

In the following pages the whole story is told in his own words:

AS A CHILD

*I was born at Shrewsbury on February 12, 1809, and my earliest recollection goes back only to when I was a few months over four years old, when we went near to Abergele, in Wales, for sea-bathing, and I recollect some events and places there with some little distinctness.

My mother died in July, 1817, when I was a little over eight years old, and it is odd that I can remember hardly anything about her except her deathbed, her black velvet gown, and her curiously constructed work-table. In the spring of this same year I was sent to a day-school in Shrewsbury, where I stayed a year. I have been told that I was much slower in learning than my younger sister Catherine, and I believe that I was in many ways a naughty boy.

By the time I went to this day-school my taste for natural history, and more especially for collecting, was well developed. I tried to make out the names of plants, and collected all sorts of things: shells, seals, franks, coins, and minerals.

*From his Autobiography in the "Life and Letters," ed. by Francis Darwin. D. Appleton & Co.

The passion for collecting which leads a man to be a systematic naturalist, a virtuoso, or a miser, was very strong in me, and was clearly innate, as none of my sisters or brother ever had this taste.

One little event during this year has fixed itself very firmly in my mind, and I hope that it has done so from my conscience having been afterward sorely troubled by it; it is curious as showing that apparently I was interested at this early age in the variability of plants. I told another little boy (I believe it was Leighton, who afterward became a well-known lichenologist and botanist), that I could produce variously coloured polyanthuses and primroses by watering them with certain coloured fluids, which was of course a monstrous fable, and had never been tried by me. I may here also confess that as a little boy I was much given to inventing deliberate falsehoods, and this was always done for the sake of causing excitement. For instance, I once gathered much valuable fruit from my father's trees and hid it in the shrubbery, and then ran in breathless haste to spread the news that I had discovered a hoard of stolen fruit.

AS A SCHOOLBOY

In the summer of 1818 I went to Dr. Butler's great school in Shrewsbury, and remained there

for seven years till mid-summer 1825, when I was sixteen years old. I boarded at this school, so that I had the great advantage of living the life of a true schoolboy; but as the distance was hardly more than a mile to my home, I very often ran there in the longer intervals between the callings over and before locking up at night. This, I think, was in many ways advantageous to me by keeping up home affections and interests. I remember in the early part of my school life that I often had to run very quickly to be in time, and from being a fleet runner was generally successful; but when in doubt I prayed earnestly to God to help me, and I well remember that I attributed my success to the prayers and not to my quick running, and marvelled how generally I was aided.

I have heard my father and elder sister say that I had, as a very young boy, a strong taste for long, solitary walks; but what I thought about I know not. I often became quite absorbed, and once, whilst returning to school on the summit of the old fortifications round Shrewsbury, which had been converted into a public foot path with no parapet on one side, I walked off and fell to the ground, but the height was only seven or eight feet. Nevertheless, the number of thoughts which passed through my mind during this very short but sudden and wholly unexpected fall was aston-

ishing, and seem hardly compatible with what physiologists have, I believe, proved about each thought requiring quite an appreciable amount of time.

Nothing could have been worse for the development of my mind than Dr. Butler's school, as it was strictly classical, nothing else being taught, except a little ancient geography and history. The school as a means of education to me was simply a blank. During my whole life I have been singularly incapable of mastering any language. Especial attention was paid to verse-making, and this I could never do well. I had many friends, and got together a good collection of old verses, which, by patching together, sometimes aided by other boys, I could work into any subject. Much attention was paid to learning by heart the lessons of the previous day; this I could effect with great facility, learning forty or fifty lines of Virgil or Homer whilst I was in morning chapel; but this exercise was utterly useless, for every verse was forgotten in forty-eight hours. I was not idle, and with the exception of versification, generally worked conscientiously at my classics, not using cribs. The sole pleasure I ever received from such studies was from some of the odes of Horace, which I admired greatly.

When I left the school I was for my age neither high nor low in it; and I believe that I

was considered by all my masters and by my father as a very ordinary boy, rather below the common standard in intellect. To my deep mortification my father once said to me, "You care for nothing but shooting, dogs, and rat-catching, and you will be a disgrace to yourself and all your family." But my father, who was the kindest man I ever knew and whose memory I love with all my heart, must have been angry and somewhat unjust when he used such words.

Looking back as well as I can at my character during my school life, the only qualities which at this period promised well for the future were, that I had strong and diversified tastes, much zeal for whatever interested me, and a keen pleasure in understanding any complex subject or thing. I was taught Euclid by a private tutor, and I distinctly remember the intense satisfaction which the clear, geometrical proofs gave me. I remember, with equal distinctness, the delight which my uncle gave me (the father of Francis Galton) by explaining the principle of the vernier of a barometer. With respect to diversified tastes, independently of science, I was fond of reading various books, and I used to sit for hours reading the historical plays of Shakespeare, generally in an old window in the thick walls of the school. I read also other poetry, such as Thomson's "Seasons," and the recently published poems of Byron and Scott.

I mention this because later in life I wholly lost, to my great regret, all pleasure from poetry of any kind, including Shakespeare. In connection with pleasure from poetry, I may add that in 1822 a vivid delight in scenery was first awakened in my mind, during a riding tour on the borders of Wales, and this has lasted longer than any other æsthetic pleasure.

Early in my school days a boy had a copy of the "Wonders of the World," which I often read, and disputed with other boys about the veracity of some of the statements; and I believe that this book first gave me a wish to travel in remote countries, which was ultimately fulfilled by the voyage of the *Beagle*.

AT EDINBURGH UNIVERSITY

Toward the close of my school life my brother worked hard at chemistry, and made a fair laboratory with proper apparatus in the tool-house in the garden, and I was allowed to aid him as a servant in most of his experiments. He made all the gases and many compounds, and I read with great care several books on chemistry, such as Henry and Parkes's "Chemical Catechism." The subject interested me greatly and we often used to go on working till rather late at night. This was the best part of my education at school, for it showed me prac-

tically the meaning of experimental science. The fact that we worked at chemistry somehow got known at school, and as it was an unprecedented fact, I was nicknamed "Gas." I was also once publicly rebuked by the head-master, Dr. Butler, for thus wasting my time on such useless subjects; and he called me very unjustly a trifler, and it seemed to me a fearful reproach.

As I was doing no good at school, my father wisely took me away at a rather earlier age than usual, and sent me (October, 1825) to Edinburgh University with my brother, where I stayed for two years or sessions. My brother was completing his medical studies, though I do not believe he ever really intended to practise, and I was sent there to commence them. But soon after this period I became convinced from various small circumstances that my father would leave me property enough to subsist on with some comfort, though I never imagined that I should be so rich a man as I am; but my belief was sufficient to check any strenuous efforts to learn medicine.

The instruction at Edinburgh was altogether by lectures, and these were intolerably dull, with the exception of those on chemistry by Hope; but to my mind there are no advantages and many disadvantages in lectures compared with reading. Dr. Duncan's lectures on Materi

Medica at eight o'clock on a winter's morning are something fearful to remember. Dr. — made his lectures on human anatomy as dull as he was himself, and the subject disgusted me. It has proved one of the greatest evils in my life that I was not urged to practise dissection, for I should soon have got over my disgust; and the practice would have been invaluable for all my future work. This has been an irremediable evil, as well as my incapacity to draw. I also attended regularly the clinical wards in the hospital. Some of the cases distressed me a good deal, and I still have vivid pictures before me of some of them; but I was not so foolish as to allow this to lessen my attendance. I cannot understand why this part of my medical course did not interest me in a greater degree; for during the summer before coming to Edinburgh I began attending some of the poor people, chiefly children and women in Shrewsbury; I wrote down as full an account as I could of the cases with all the symptoms, and read them aloud to my father, who suggested further inquiries and advised me what medicines to give, which I made up myself. At one time I had at least a dozen patients, and I felt a keen interest in the work. My father, who was by far the best judge of character whom I ever knew, declared that I should make a successful physician—meaning by this one

who would get many patients. He maintained that the chief element of success was exciting confidence; but what he saw in me which convinced him that I should create confidence I know not. I also attended on two occasions the operating theatre in the hospital at Edinburgh, and saw two very bad operations, one on a child, but I rushed away before they were completed. Nor did I ever attend again, for hardly any inducement would have been strong enough to make me do so; this being long before the blessed days of chloroform. The two cases fairly haunted me for many a long year.

My brother stayed only one year at the University, so that during the second year I was left to my own resources; and this was an advantage, for I became well acquainted with several young men fond of natural sciences. One of these was Ainsworth, who afterward published his travels in Assyria; he was a Wernerian geologist, and knew a little about many subjects. Dr. Coldstream was a very different young man, prim, formal, highly religious, and most kindhearted; he afterward published some good zoölogical articles. A third young man was Hardie, who would, I think, have made a good botanist, but died early in India. Lastly, Dr. Grant, my senior by several years, but how I became acquainted with him I cannot remember; he published some first-rate

zoölogical papers, but after coming to London as professor in University College, he did nothing more in science, a fact which has always been inexplicable to me. I knew him well; he was dry and formal in manner, with much enthusiasm beneath this outer crust. He one day, when we were walking together, burst forth in high admiration of Lamarck and his views on evolution. I listened in silent astonishment, and as far as I can judge without any effect on my mind. I had previously read the "Zoönomia" of my grandfather, Erasmus Darwin, in which similar views are maintained, but without producing any effect on me. Nevertheless, it is probable that the hearing rather early in life such views maintained and praised may have favoured my upholding them under a different form in my "Origin of Species." At this time I admired greatly the "Zoönomia"; but on reading it a second time, after an interval of ten or fifteen years, I was much disappointed; the proportion of speculation being so large to the facts given.

AT CAMBRIDGE UNIVERSITY

[After two sessions at Edinburgh University Darwin proceeded to Cambridge.]

During the three years which I spent at Cambridge my time was wasted, as far as the academ-

ical studies were concerned, as completely as at Edinburgh and at school. I attempted mathematics, and even went during the summer of 1828 with a private tutor (a very dull man) to Barmouth, but I got on very slowly. The work was repugnant to me, chiefly from my not being able to see any meaning in the early steps in algebra. This impatience was very foolish, and in after years I have deeply regretted that I did not proceed far enough at least to understand something of the great leading principles of mathematics, for men thus endowed seem to have an extra sense. But I do not believe that I should ever have succeeded beyond a very low grade. With respect to Classics I did nothing except attend a few compulsory college lectures, and the attendance was almost nominal. In my second year I had to work for a month or two to pass the preliminary examination, which I did easily. Again, in my last year, I worked with some earnestness for my final degree of B. A., and brushed up my Classics, together with a little Algebra and Euclid, which latter gave me much pleasure, as it did at school. In order to pass the B. A. examination, it was also necessary to get up Paley's "Evidences of Christianity," and his "Moral Philosophy." This was done in a thorough manner, and I am convinced that I could have written out the whole of the "Evidences" with perfect correct-

ness, but not of course in the clear language of Paley. The logic of this book and, as I may add, of this "Natural Theology," gave me as much delight as did Euclid. The careful study of these works, without attempting to learn any part by rote, was the only part of the academical course which, as I then felt and as I still believe, was of the least use to me in the education of my mind. I did not at that time trouble myself about Paley's premises; and taking these on trust, I was charmed and convinced by the long line of argumentation. By answering well the examination questions in Paley, by doing Euclid well, and by not failing miserably in Classics, I gained a good place among the crowd of men who do not go in for honours. Oddly enough, I cannot remember how high I stood, and my memory fluctuates between the fifth, tenth, or twelfth name on the list. (He was tenth.)

Public lectures on several branches were given in the University, attendance being quite voluntary; but I was so sickened with lectures at Edinburgh that I did not even attend Sedgwick's eloquent and interesting lectures. Had I done so I should probably have become a geologist earlier than I did. I attended, however, Henslow's lectures on Botany, and liked them much for their extreme clearness and the admirable illustrations; but I did not study

botany. Henslow used to take his pupils, including several of the older members of the University, field excursions, on foot or in coaches to distant places, or in a barge down the river, and lectured on the rarer plants and animals which were observed. These excursions were delightful.

AS A COLLECTOR

But no pursuit at Cambridge was followed with nearly so much eagerness or gave me so much pleasure as collecting beetles. It was the mere passion for collecting, for I did not dissect them, and rarely compared their external characters with published descriptions, but got them named anyhow. I will give a proof of my zeal: One day, on tearing off some old bark, I saw two rare beetles, and seized one in each hand; then I saw a third and new kind, which I could not bear to lose, so that I popped the one which I held in my right hand into my mouth. Alas! it ejected some intensely acrid fluid, which burnt my tongue so that I was forced to spit the beetle out, which was lost, as was the third one.

I was very successful in collecting, and invented two new methods. I employed a labourer to scrape, during the winter, moss off the old trees and place it in a large bag, and likewise to collect the rubbish at the bottom of the barges

in which reeds are brought from the fens, and thus I got some very rare species. No poet ever felt more delighted at seeing his first poem published than I did at seeing, in Stephens's "Illustrations of British Insects," the magic words, "captured by C. Darwin, Esq." I was introduced to entomology by my second cousin, W. Darwin Fox, a clever and most pleasant man, who was then at Christ's College, and with whom I became extremely intimate. Afterward I became well acquainted, and went out collecting, with Albert Way of Trinity, who in after years became a well-known archæologist; also with H. Thompson of the same college, afterward a leading agriculturist, chairman of a great railway,¹ and Member of Parliament. It seems, therefore, that a taste for collecting beetles is some indication of future success in life!

VOYAGE OF THE "BEAGLE" FROM DECEMBER
27, 1831, TO OCTOBER 2, 1836

On returning home in the summer of 1831, from a short geological tour in North Wales, I found a letter from Henslow [Professor of Botany at Cambridge], informing me that Captain Fitz-Roy was willing to give up part of his own cabin to any young man who would volunteer to go with him without pay as naturalist to the voyage of the *Beagle*. I have given,

as I believe, in my MS. Journal an account of all the circumstances which then occurred. I will here only say that I was instantly eager to accept the offer, but my father strongly objected, adding the words, fortunate for me, "If you can find any man of common sense who advises you to go I will give my consent." So I wrote that evening and refused the offer. On the next morning I went to Maer to be ready for September 1st, and, whilst out shooting, my uncle, Josiah Wedgwood, sent for me, offering to drive me over to Shrewsbury and talk with my father, as my uncle thought it would be wise in me to accept the offer. My father always maintained that he was one of the most sensible men in the world, and he at once consented in the kindest manner. I had been rather extravagant at Cambridge, and to console my father, said, "that I should be deuced clever to spend more than my allowance whilst on board the *Beagle*," but he answered with a smile, "But they tell me you are very clever."

Next day I started for Cambridge to see Henslow, and thence to London to see Fitz-Roy, and all was soon arranged. Afterward, on becoming very intimate with Fitz-Roy, I heard that I had run a very narrow risk of being rejected, on account of the shape of my nose! He was an ardent disciple of Lavater, and was convinced that he could judge of a man's char-

acter by the outline of his features; and he doubted whether any one with my nose could possess sufficient energy and determination for the voyage. But I think he was afterward well satisfied that my nose had spoken falsely.

The voyage of the *Beagle* has been by far the most important event in my life, and has determined my whole career; yet it depended on so small a circumstance as my uncle offering to drive me thirty miles to Shrewsbury, which few uncles would have done, and on such a trifle as the shape of my nose. I have always felt that I owe to the voyage the first real training or education of my mind; I was led to attend closely to several branches of natural history, and thus my powers of observation were improved, though they were always fairly developed.

The investigation of the geology of all the places visited was far more important, as reasoning here comes into play. On first examining a new district nothing can appear more hopeless than the chaos of rocks; but by recording the stratification and nature of the rocks and fossils at many points, always reasoning and predicting what will be found elsewhere, light soon begins to dawn on the district, and the structure of the whole becomes more or less intelligible. I had brought with me the first volume of Lyell's

"Principles of Geology," which I studied attentively; and the book was of the highest service to me in many ways. The very first place which I examined, namely St. Jago in the Cape de Verde Islands, showed me clearly the wonderful superiority of Lyell's manner of treating geology, compared with that of any other author whose works I had with me or ever afterward read.

Another of my occupations was collecting animals of all classes, briefly describing and roughly dissecting many of the marine ones; but from not being able to draw, and from not having sufficient anatomical knowledge, a great pile of MS. which I made during the voyage has proved almost useless. I thus lost much time, with the exception of that spent in acquiring some knowledge of the Crustaceans, as this was of service when in after years I undertook a monograph of the Cirripedia [Barnacles].

During some part of the day I wrote my Journal of Researches, and took much pains in describing carefully and vividly all that I had seen; and this was good practice. My journal served also, in part, as letters to my home, and portions were sent to England whenever there was an opportunity.

The above various special studies were, however, of no importance compared with the habit of energetic industry and of concentrated at-

tention to whatever I was engaged in, which I then acquired. Everything about which I thought or read was made to bear directly on what I had seen or was likely to see; and this habit of mind was continued during the five years of the voyage. I feel sure that it was this training which has enabled me to do whatever I have done in science.

Looking backward, I can now perceive how my love for science gradually preponderated over every other taste. During the first two years my old passion for shooting survived in nearly full force, and I shot myself all the birds and animals for my collection; but gradually I gave up my gun more and more, and finally altogether, to my servant, as shooting interfered with my work, more especially with making out the geological structure of a country. I discovered, though unconsciously and insensibly, that the pleasure of observing and reasoning was a much higher one than that of skill and sport. That my mind became developed through my pursuits during the voyage is rendered probable by a remark made by my father, who was the most acute observer whom I ever saw, of a sceptical disposition, and far from being a believer in phrenology; for on first seeing me after the voyage, he turned round to my sisters, and exclaimed, "Why, the shape of his head is quite altered."

FIRST BOOKS

In the early part of 1844 my observations on the volcanic islands visited during the voyage of the *Beagle* were published. In 1845 I took much pains in correcting a new edition of my "Journal of Researches" in the natural history and geology of the countries visited by the *Beagle*, which was originally published in 1839 as part of Fitz-Roy's work. The success of this, my first literary child, always tickles my vanity more than that of any of my other books. Even to this day it sells steadily in England and the United States, and has been translated for the second time into German, and into French and other languages. This success of a book of travels, especially of a scientific one, so many years after its first publication, is surprising. Ten thousand copies have been sold in England of the second edition. In 1846 my "Geological Observations on South America" were published. I record in a little diary, which I have always kept, that my three geological books ("Coral Reefs" included) consumed four and a half years' steady work; "and now it is ten years since my return to England. How much time have I lost by illness!" I have nothing to say about these three books except that to my

surprise new editions have lately been called for.

LATER BOOKS

[In November, 1859, Darwin's "Origin of Species," his most famous book, was published. His account of how he came to write it is reprinted in "The Naturalist," one of the six volumes of "Little Masterpieces of Science," published by Doubleday, Page & Co., New York.]

In the autumn of 1864 I finished a long paper on "Climbing Plants," and sent it to the Linnean Society. The writing of this paper cost me four months; but I was so unwell when I received the proof-sheets that I was forced to leave them very badly and often obscurely expressed. The paper was little noticed, but when in 1875 it was corrected and published as a separate book it sold well. I was led to take up this subject by reading a short paper by Asa Gray, published in 1858. He sent me seeds, and on raising some plants I was so much fascinated and perplexed by the revolving movements of the tendrils and stems, which movements are really very simple, though appearing at first sight very complex, that I procured various other kinds of climbing plants, and studied the whole subject. I was all the more attracted to it, from not being at all satisfied

with the explanation which Henslow gave us in his lectures about twining plants, namely, that they had a natural tendency to grow up in a spire. This explanation proved quite erroneous. Some of the adaptations displayed by climbing plants are as beautiful as those of orchids for ensuring cross-fertilization.

My "Variation of Animals and Plants under Domestication" was begun, as already stated, in the beginning of 1860, but was not published until the beginning of 1868. It was a big book, and cost me four years and two months' hard labour. It gives all my observations and an immense number of facts collected from various sources about our domestic productions. In the second volume the causes and laws of variation, inheritance, etc., are discussed as far as our present state of knowledge permits. Toward the end of the work I give my well-abused hypothesis of pangenesis. An unverified hypothesis is of little or no value; but if any one should hereafter be led to make observations by which some such hypothesis could be established, I shall have done good service, as an astonishing number of isolated facts can be thus connected together and rendered intelligible. In 1875 a second and largely corrected edition, which cost me a good deal of labour, was brought out.

My "Descent of Man" was published in

February, 1871. As soon as I had become, in the year 1837 or 1838, convinced that species were mutable productions, I could not avoid the belief that man must come under the same law. Accordingly I collected notes on the subject for my own satisfaction, and not for a long time with any intention of publishing. Although in the "Origin of Species" the derivation of any particular species is never discussed, yet I thought it best, in order that no honourable man should accuse me of concealing my views, to add that by the work "light would be thrown on the origin of man and his history." It would have been useless and injurious to the success of the book to have paraded, without giving any evidence, my conviction with respect to his origin.

But when I found that many naturalists fully accepted the doctrine of the evolution of species, it seemed to me advisable to work up such notes as I possessed, and to publish a special treatise on the origin of man. I was the more glad to do so, as it gave me an opportunity of fully discussing sexual selection—a subject which had always greatly interested me. This subject, and that of the variation of our domestic productions, together with the causes and laws of variation, inheritance, and the intercrossing of plants, are the sole subjects which I have been able to write about in full,

so as to use all the materials which I have collected. The "Descent of Man" took me three years to write, but then as usual some of this time was lost by ill health, and some was consumed by preparing new editions and other minor works. A second and largely corrected edition of the "Descent" appeared in 1874.

OBSERVES HIS FIRST CHILD

My first child was born on December 27, 1839, and I at once commenced to make notes on the first dawn of the various expressions which he exhibited, for I felt convinced, even at this early period, that the most complex and fine shades of expression must all have had a gradual and natural origin. During the summer of the following year, 1840, I read Sir Charles Bell's admirable work on expression, and this greatly increased the interest which I felt in the subject, though I could not at all agree with his belief that various muscles had been specially created for the sake of expression. From this time forward I occasionally attended to the subject, both with respect to man and our domesticated animals.

In the summer of 1860 I was idling and resting near Hatfield, where two species of *Drosera* [sundew] abound; and I noticed that numerous insects had been entrapped by the leaves. I

carried home some plants, and on giving them insects saw the movements of the tentacles, and this made me think it probable that the insects were caught for some special purpose. Fortunately a crucial test occurred to me, that of placing a large number of leaves in various nitrogenous and non-nitrogenous fluids of equal density; and as soon as I found that the former alone excited energetic movements, it was obvious that here was a fine new field for investigation.

EXAMINES HIS OWN MIND AND CHARACTER

I have now mentioned all the books which I have published, and these have been the milestones in my life, so that little remains to be said. I am not conscious of any change in my mind during the last thirty years, excepting in one point presently to be mentioned; nor, indeed, could any change have been expected unless one of general deterioration. But my father lived to his eighty-third year with his mind as lively as it ever was, and all his faculties undimmed; and I hope that I may die before my mind fails to a sensible extent. I think that I have become a little more skilful in guessing right explanations, and in devising experimental tests; but this may probably be the result of mere practice, and of a larger store

of knowledge. I have as much difficulty as ever in expressing myself clearly and concisely; and this difficulty has caused me a very great loss of time; but it has had the compensating advantage of forcing me to think long and intently about every sentence, and thus I have been led to see errors in reasoning and in my own observations or those of others.

There seems to be a sort of fatality in my mind leading me to put at first my statement or proposition in a wrong or awkward form. Formerly I used to think about my sentences before writing them down; but for several years I have found that it saves time to scribble in a vile hand whole pages as quickly as I possibly can, contracting half the words, and then correct deliberately. Sentences thus scribbled down are often better ones than I could have written deliberately.

Having said thus much about my manner of writing, I will add that with my large books I spend a good deal of time over the general arrangement of the matter. I first make the rudest outline in two or three pages, and then a larger one in several pages, a few words or one word standing for a whole discussion or series of facts. Each one of these headings is again enlarged and often transferred before I begin to write *in extenso*. As in several of my books facts observed by others have been very exten-

sively used, and as I have always had several quite distinct subjects in hand at the same time, I may mention that I keep from thirty to forty large portfolios, in cabinets with labelled shelves, into which I can at once put a detached reference or memorandum. I have bought many books, and at their ends I make an index of all the facts that concern my work; or, if the book is not my own, write out a separate abstract, and of such abstracts I have a large drawer full. Before beginning on any subject I look to all the short indexes and make a general and classified index, and by taking the one or more proper portfolios I have all the information collected during my life ready for use.

I have said that in one respect my mind has changed during the last twenty or thirty years. Up to the age of thirty, or beyond it, poetry of many kinds, such as the works of Milton, Gray, Byron, Wordsworth, Coleridge, and Shelley gave me great pleasure, and even as a schoolboy I took intense delight in Shakespeare, especially in the historical plays. I have also said that formerly pictures gave me considerable, and music very great, delight. But now for many years I cannot endure to read a line of poetry: I have tried lately to read Shakespeare, and found it so intolerably dull that it nauseated me. I have also almost lost my taste for pictures or music. Music generally sets me thinking too

energetically on what I have been at work on, instead of giving me pleasure. I retain some taste for fine scenery, but it does not cause me the exquisite delight which it formerly did. On the other hand, novels which are works of the imagination, though not of a very high order, have been for years a wonderful relief and pleasure to me, and I often bless all novelists. A surprising number have been read aloud to me, and I like all if moderately good, and if they do not end unhappily—against which a law ought to be passed. A novel, according to my taste, does not come into the first class unless it contains some person whom one can thoroughly love, and if a pretty woman all the better.

This curious and lamentable loss of the higher æsthetic tastes is all the odder, as books on history, biographies, and travels (independently of any scientific facts which they may contain), and essays on all sorts of subjects interest me as much as ever they did. My mind seems to have become a kind of machine for grinding general laws out of large collections of facts, but why this should have caused the atrophy of that part of the brain alone, on which the higher tastes depend, I cannot conceive. A man with a mind more highly organized or better constituted than mine, would not, I suppose, have thus suffered; and if I had to live my life

again, I would have made a rule to read some poetry and listen to some music at least once every week; for perhaps the parts of my brain now atrophied would thus have been kept active through use. The loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature.

My books have sold largely in England, have been translated into many languages, and passed through several editions in foreign countries. I have heard it said that the success of a work abroad is the best test of its enduring value. I doubt whether this is at all trustworthy; but judged by this standard my name ought to last for a few years. Therefore it may be worth while to try to analyze the mental qualities and the conditions on which my success has depended; though I am aware that no man can do this correctly.

I have no great quickness of apprehension or wit which is so remarkable in some clever men, for instance, Huxley. I am therefore a poor critic: a paper or book, when first read, generally excites my admiration, and it is only after considerable reflection that I perceive the weak points. My power to follow a long and purely abstract train of thought is very limited; and therefore I could never have succeeded with

metaphysics or mathematics. My memory is extensive, yet hazy: it suffices to make me cautious by vaguely telling me that I have observed or read something opposed to the conclusion which I am drawing, or, on the other hand, in favour of it; and after a time I can generally recollect where to search for my authority. So poor in one sense is my memory, that I have never been able to remember for more than a few days a single date or a line of poetry.

Some of my critics have said, "Oh, he is a good observer, but he has no power of reasoning!" I do not think that this can be true, for the "Origin of Species" is one long argument from the beginning to the end, and it has convinced not a few able men. No one could have written it without having some power of reasoning. I have a fair share of invention, and of common sense or judgment such as every fairly successful lawyer or doctor must have, but not, I believe, in any higher degree.

On the favourable side of the balance, I think that I am superior to the common run of men in noticing things which easily escape attention, and in observing them carefully. My industry has been nearly as great as it could have been in the observation and collection of facts. What is far more important, my love of natural science has been steady and ardent.

This pure love has, however, been much aided

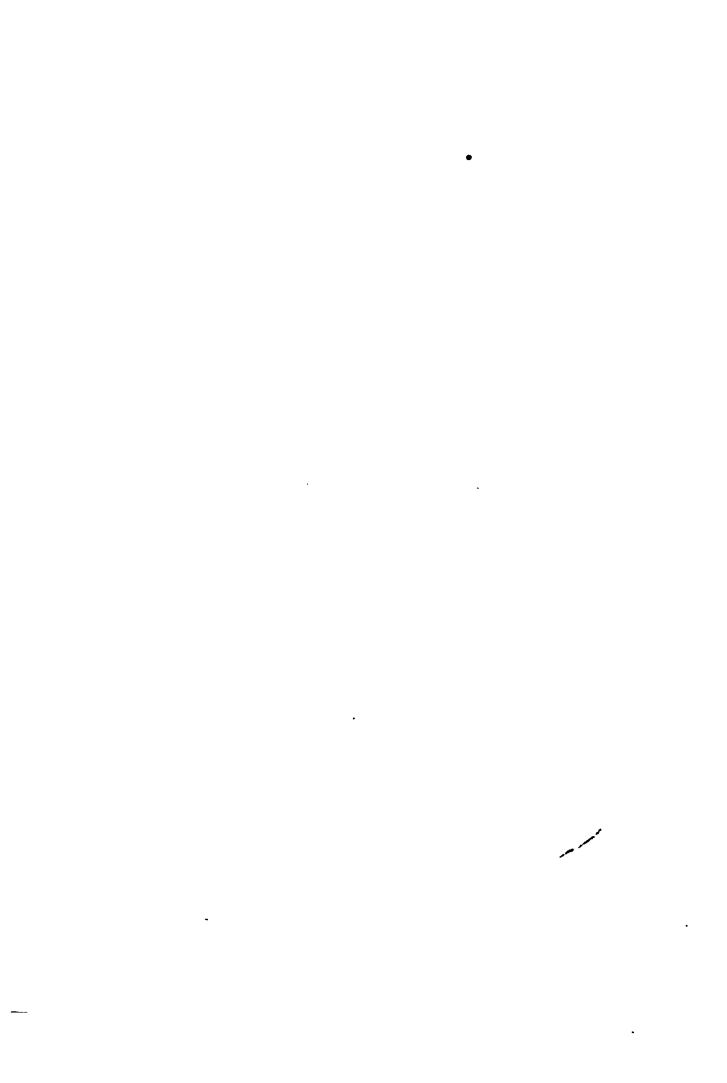
by the ambition to be esteemed by my fellow-naturalists. From my early youth I have had the strongest desire to understand or explain whatever I observed—that is, to group all facts under some general laws. These causes combined have given me the patience to reflect or ponder for any number of years over any unexplained problem. As far as I can judge I am not apt to follow blindly the lead of other men. I have steadily endeavoured to keep my mind free so as to give up any hypothesis, however much beloved (and I cannot resist forming one on every subject), as soon as facts are shown to be opposed to it. Indeed, I have had no choice but to act in this manner, for with the exception of the coral reefs I cannot remember a single first-formed hypothesis which had not after a time to be given up or greatly modified. This has naturally led me to distrust greatly deductive reasoning in the mixed sciences. On the other hand, I am not very sceptical—a frame of mind which I believe to be injurious to the progress of science. A good deal of scepticism in a scientific man is advisable to avoid much loss of time, but I have met with not a few men, who, I feel sure, have often thus been deterred from experiment or observations which would have proved directly or indirectly serviceable. . . .

My habits are methodical, and this has been of not a little use for my particular line of work.

Lastly, I have had ample leisure from not having to earn my own bread. Even ill-health, though it has annihilated several years of my life, has saved me from the distractions of society and amusement.

Therefore my success as a man of science, whatever this may have amounted to, has been determined, as far as I can judge, by complex and diversified mental qualities and conditions. Of these, the most important have been the love of science, unbounded patience in long reflecting over any subject, industry in observing and collecting facts, and a fair share of invention as well as of common sense. With such moderate abilities as I possess, it is truly surprising that I should have influenced to a considerable extent the belief of scientific men on some important points.

SIR HENRY MORTON STANLEY
(1841-1904)



SIR HENRY MORTON STANLEY

HOW JOHN ROWLANDS BECAME HENRY M. STANLEY

SIR HENRY M. STANLEY was of lowly birth, and much of his childhood was spent in a workhouse. But a spirit such as his can never be long confined within workhouse walls, or condemned to a life of obscurity. He soon found means to help himself.

It is good to know that after many years of strenuous exertion and privation as soldier, sailor, war correspondent, and African explorer, the evening of his days was spent in comfort and domestic tranquillity, an honored citizen of his native land.

*My father I never knew. I was in my teens before I learned that he had died within a few weeks after my birth. . . .

One of the first things I remember is to have been gravely told that I had come from London in a band-box, and to have been assured that all babies came from the same place. It satisfied

*From "The Autobiography of Sir Henry Morton Stanley." Houghton Mifflin Company, 1909.

my curiosity for several years as to the cause of my coming; but, later, I was informed that my mother had hastened to her parents from London to be delivered of me; and that, after recovery, she had gone back to the metropolis, leaving me in the charge of my grandfather, Moses Parry, who lived within the precincts of Denbigh Castle. . . .

My grandfather appears to me as a stout old gentleman, clad in corduroy breeches, dark stockings, and long Melton coat, with a clean-shaven face, rather round, and lit up by humorous gray eyes. He and I occupied the top floor, which had an independent entrance from the garden. The lower rooms were inhabited by my uncles, Moses and Thomas. By and by there came a change. My strong, one-armed Uncle Moses married a woman named Kitty, a flaxen-haired, fair girl of a decided temper; and after that event we seldom descended to the lower apartments.

I have a vivid remembrance of Sunday evenings at a Wesleyan chapel, on account of the tortures which I endured. The large, galleried building, crowded with fervid worshippers, and the deep murmur of "Amens," the pious ejaculations, are well remembered, as well as the warm atmosphere and curious scent of lavender which soon caused an unconquerable drowsiness in me. Within a short time my

head began to nod heavily, to the great danger of my neck, and the resolute effort I made to overcome this sleepiness, to avoid the reproaches of my grandfather, who affected to be shocked at my extraordinary behaviour, caused the conflict with nature to be so painful that it has been impossible for me to forget the chapel and its scenes. . . .

Soon after [the death of Moses Parry] I was transferred to the care of an ancient couple who lived at the other end of the castle, named Richard and Jenny Price, keepers of the Bowling Green, into which one of the courts of the old castle had been converted. The rate for my maintenance was fixed at half a crown a week, which my two uncles agreed to pay to the Prices. Old Richard Price, besides being a gamekeeper, was sexton of Whitchurch, and verger of St. David's. His wife Jenny, a stout and buxom old lady, is remembered by me mostly for her associations with "peas-pudding," for which I had a special aversion, and for her resolute insistence that, whether I liked it or not, I should eat it. . . .

I am under the impression that during the day, for a portion of this period, I was sent to an infant's school, where there was a terrible old lady who is associated in my mind with spectacles and a birch rod; but I have no particular incident connected with it to make it definite.

Richard Price and his wife Jenny seemed to have, at last, become dismayed at my increasing appetite, and to have demanded a higher rate for my maintenance. As both my uncles had in the meantime married, and through the influence of their wives declined to be at further charge for me, the old couple resolved to send me to the workhouse. Consequently Dick Price, the son, took me by the hand one day, Saturday, February 20, 1847, and, under the pretence that we were going to Aunt Mary at Fynnon Beuno, induced me to accompany him on a long journey.

The way seemed interminable and tedious, but he did his best to relieve my fatigue with false cajolings and treacherous endearments. At last Dick set me down from his shoulders before an immense stone building, and, passing through tall iron gates, he pulled at a bell, which I could hear clanging noisily in the distant interior. A sombre-faced stranger appeared at the door, who, despite my remonstrances, seized me by the hand, and drew me within, while Dick tried to soothe my fears with glib promises that he was only going to bring Aunt Mary to me. The door closed on him, and, with the echoing sound, I experienced for the first time the awful feeling of utter desolation.

The great building with the iron gates and

innumerable windows, into which I had been so treacherously taken, was the St. Asaph Union Workhouse. It is an institution to which the aged poor and superfluous children of that parish are taken, to relieve the respectabilities of the obnoxious sight of extreme poverty, and because civilization knows no better method of disposing of the infirm and helpless than by imprisoning them within its walls. . . .

It took me some time to learn the unimportance of tears in a workhouse. Hitherto tears had brought me relief in one shape or another, but from this time forth they availed nothing. James Francis, the one-handed schoolmaster into whose stern grasp Dick Price had resigned me, was little disposed to soften the blow dealt my sensibilities by treachery. Though forty-five years have passed since that dreadful evening, my resentment has not a whit abated. Dick's guile was well meant, no doubt, but I then learned for the first time that one's professed friend can smile while preparing to deal a mortal blow, and that a man can mask evil with a show of goodness. It would have been far better for me if Dick, being stronger than I, had employed compulsion, instead of shattering my confidence and planting the first seeds of distrust in a child's heart.

Francis, soured by misfortune, brutal of temper, and callous of heart, through years of

control over children, was not a man to understand the cause of my inconsolable grief. Nor did he try. Time, however, alleviated my affliction, and the lapse of uncounted days, bringing their quota of smarts and pains, tended to harden the mind for life's great task of suffering. No Greek helot or dark slave ever underwent such discipline as the boys of St. Asaph under the heavy masterful hand of James Francis. The ready back-slap in the face, the stunning clout over the ear, the strong blow with the open palm on alternate cheeks, which knocked our senses into confusion, were so frequent that it is a marvel we ever recovered them again. Whatever might be the nature of the offence, or merely because his irritable mood required vent, our poor heads were cuffed, and slapped, and pounded, until we lay speechless and streaming with blood. But though a tremendously rough and reckless striker with his fist or hand, such blows were preferable to deliberate punishment with the birch, ruler, or cane, which, with cool malice, he inflicted. These instruments were always kept ready at hand. It simply depended upon how far the victim was from him, or how great was his fury, as to which he would choose to castigate us with. If we happened to be called up to him to recite our lessons, then the bony hand flew mercilessly about our faces and heads, or

rammed us in the stomach until our convulsions became alarming. If, while at the desk, he was reading to us, he addressed a question to some boy, the slightest error in reply would either be followed by a stinging blow from the ruler, or a thwack with his blackthorn. If a series of errors were discovered in our lessons, then a vindictive scourging of the offender followed, until he was exhausted, or our lacerated bodies could bear no more.

My first flogging is well remembered, and illustrates the man's temper and nature thoroughly, and proves that we were more unfortunate than vicious. It was a Sunday evening in the early part of 1849. Francis was reading aloud to us the forty-first chapter of Genesis, preliminary to dismissing us to our dormitory. There was much reference in the chapter to Joseph, who had been sold as a slave by his brothers, and had been promoted to high rank by Pharaoh. In order to test our attention he suddenly looked up and demanded of me who it was that had interpreted the dream of the King. With a proud confidence I promptly replied:

"Jophes, sir."

"Who?"

"Jophes, sir."

"Joseph, you mean."

"Yes, sir, Jophes."

Despite his repeated stern shouts of "Joseph," I as often replied "Jophes," wondering more and more at his rising wrath, and wherein lay the difference between the two names.

He grew tired at last, and laying hold of a new birch rod he ordered me to unbreech, upon which I turned marble-white, and for a moment was as one that is palsied, for my mind was struggling between astonishment, terror, and doubt as to whether my ears had heard aright, and why I was chosen to be the victim of his anger. This hesitation increased his wrath, and while I was still inwardly in a turmoil he advanced upon me and rudely tore down my nether garment and administered a forceful shower of blows, with such thrilling effect that I was bruised and bloodied all over, and could not stand for a time. During the hour that followed I remained as much perplexed at the difference between "Jophes" and "Joseph" as at the peculiar character of the agonizing pains I suffered. For some weeks I was under the impression that the scourging was less due to my error than to some mysterious connection it might have with Genesis.

With such a passionate teacher it may be imagined that we children increased his displeasure times without number. The restlessness of childhood, and nature's infirmities, contributed endless causes for correction. The un-

quiet feet, the lively tongues, defects of memory, listlessness, the effects of the climate, all sufficed to provoke his irritation, and to cause us to be summarily castigated with birch or stick, or pummelled without mercy.

Day after day little wretches would be flung down on the stone floor in writhing heaps, or stood, with blinking eyes and humped backs, to receive the shock of the ebony ruler, or were sent pirouetting across the school from a ruffianly kick, while the rest suffered from a sympathetic terror during such exhibitions, for none knew what moment he might be called to endure the like. Every hour of our lives we lived and breathed in mortal fear of the cruel hand and blighting glare of one so easily frenzied.

The second memorable whipping I received was during the autumn of 1851, the year of Rhuddlan Eisteddfod. Cholera was reported to be in the country, and I believe we were forbidden to eat fruit of any kind. Some weeks, however, after the edict had been issued, I and the most scholarly boy in the school were sent on an errand to the Cathedral town. When returning, we caught sight of a bunch of blackberries on the other side of a hedge, and wholly oblivious of the consequences, we climbed over a gate into the field and feasted on the delicious fruit, and, of course, stained our fingers and lips.

On reporting ourselves to Francis, it was evident by the way he gazed at us both that he guessed what we had been doing, but he said nothing, and we retired from him with a sense of relief. About half an hour after we all had been dismissed to our dormitory, and we were all quiet abed, the master's tramp was heard on the stairs, and when he appeared at the door he had a birch as large as a broom in his hand.

He stood long enough to remind us all that he had expressly forbidden us to eat any fruit from stall or hedge because of the sickness that was in the country; then, giving a swishing blow in the air with his birch, he advanced to my bed and with one hand plucked me out of bed, and forthwith administered a punishment so dreadful that blackberries suggested birching ever afterward. He next went to the bed of the scholar George, who, hitherto, had escaped the experience he was now to undergo, because of his remarkable abilities. George, being new to the exquisite pain of flagellation, writhed and struggled to such an extent that he exasperated the master, and received double punishment, and his back, breast, and legs were covered with wounds.

The hard tasks imposed upon us, such as sweeping the playground with brooms more suited to giants than little children, the washing of the slated floors when one was stiff from can-

ing, the hoeing of frost-bound ground, when every stroke on it caused the nerves to quiver, the thinly clad body all the while exposed to a searching wind; the compelling us to commit whole pages to memory during the evening; in these, and scores of other ways, our treatment was ferocious and stupid.

Under such treatment as these examples describe, who could have supposed that any of the St. Asaph waifs would ever have developed into anything resembling respectable manhood? Yet several of these poor lads have since risen to receive a large measure of respect from Society. One of them has become a wealthy merchant, another is a vicar, a third is a colonial lawyer, and a fourth is a person of distinction in a South African State.

Thus there are two things for which I feel grateful to this strange institution of St. Asaph. My fellowman had denied to me the charm of affection and the bliss of a home, but through his charity I had learned to know God by faith, as the Father of the fatherless, and I had been taught to read. It is impossible that in a Christian land like Wales I could have avoided contracting some knowledge of the Creator, but the knowledge which is gained by hearing is very different from that which comes from feeling. Nor is it likely that I would have remained altogether ignorant of letters. Being as I was,

however, the circumstances of my environment necessarily focussed my attention on religion, and my utterly friendless state drove me to seek the comfort guaranteed by it.

It would be impossible to reveal myself, according to the general promise involved in the title of this book, if I were to be silent regarding my religious convictions. Were I to remain silent, the true key to the actions of my life would be missing. Or, rather, let me try to put the matter more clearly: the secret influence which inspired what good I may have done in life, for the same reason prevented me from doing evil, curbed passion, guided me when the fires of youth, licentious company, irreverent mates, and a multitude of strange circumstances must have driven me into a confirmed state of wickedness.

I was therefore grateful, after all, for the implanting of religious principles in me by the Biblical education given me in the Union. The fear of doing wrong intentionally, the feeling of reverence, the impulse of charity, the possession of a conscience are all due to this. Without this teaching I should have been little superior to the African savage. It has been the driving power for good, the arrester of evil. It has given me an acute and perceptive monitor, able by its own delicacy to perceive evil no matter how deceptive its guise. It has formed a magnet

by which to steer more straightly than I could otherwise have done.

My belief that there was a God, overseeing every action, observing and remembering, has come often between me and evil. Often when sorely tempted, came the sudden strength to say, "No, I *will* not, it will be wicked; not criminal, but sinful; God sees me." It is precisely for this strength that I am grateful. Reason would not have been sufficient to restrain me from yielding to temptation. It required a conscience, and a religious conviction created it. That same inward monitor has restrained me from uttering idle words, from deceiving my fellow-creatures with false promises, and from hastily condemning them without sufficient evidence, from listening to slanders, and from joining with them, from yielding to vindictiveness; it has softened a nature that without its silent and gentle admonitions would, I am sure, be much worse than it is. I do not claim that it has always been successful—far from it—but I am grateful for what it has done; and this feeling, so long as I possess it, will induce me to hope that it will ever remain with me, a restraining power, a monitor to do my duty to my Creator, and to my fellowmen.

Whether these religious convictions would have continued with me had I lived the life of the city is another question. I think not. At

least, not in sufficient force. A journalist's life in New York does not give time for reflection or introspection.

Religion grew deep roots in me in the solitude of Africa, so that it became my mentor in civilization, my director, my spiritual guide. With religious conviction we can make real and substantial progress; it gives body, pith, and marrow; without it so-called progress is empty and impermanent—for without the thought of God we are tossed about on a sea of uncertainty; for what is our earth compared with the vast universe of worlds in unmeasurable space? But above all the vastness of infinity, of which the thoughts of the wisest men can extend to but an infinitesimal fraction, is the Divine and Almighty Intellect, which ordered all this; and to Him I turn—the Source of the highest energy, the Generator of the principle of duty. . . .

In May, 1856, a new deal table had been ordered for the school, and some heedless urchin had dented its surface by standing on it, which so provoked Francis that he fell into a furious rage, and uttered terrific threats with the air of one resolved on massacre. He seized a birch which, as yet, had not been bloodied, and, striding furiously up to the first class, he demanded to know the culprit. It was a question that most of us would have preferred to answer straight off, but we were all absolutely ignorant

that any damage had been made, and probably the author of it was equally unaware of it. No one could remember to have seen any one standing on the table, and in what other manner mere dents had been impressed in the soft deal wood was inexplicable. We all answered accordingly.

"Very well, then," said he, "the entire class will be flogged, and, if confession is not made, I will proceed with the second, and afterward with the third. Unbutton."

He commenced at the foot of the class, and there was the usual yelling, and writhing, and shedding of showers of tears. One or two of David's oaken fibre submitted to the lacerating strokes with a silent quirm or two, and now it was fast approaching my turn; but instead of the old timidity and other symptoms of terror, I felt myself hardening for resistance. He stood before me vindictively glaring, his spectacles intensifying the gleam of his eyes.

"How is this?" he cried savagely. "Not ready yet? Strip, sir, this minute; I mean to stop this abominable and barefaced lying."

"I did not lie, sir. I know nothing of it."

"Silence, sir! Down with your clothes."

"Never again!" I shouted, marvelling at my own audacity.

The words had scarcely escaped me ere I found myself swung upward into the air by the

collar of my jacket, and flung into a nerveless heap on the bench. Then the passionate brute pummelled me in the stomach until I fell backward, gasping for breath. Again I was lifted, and dashed on the bench with a shock that almost broke my spine. What little sense was left in me after these repeated shocks made me aware that I was smitten on the cheeks, right and left, and that soon nothing would be left of me but a mass of shattered nerves and bruised muscles.

Recovering my breath, finally, from the pounding in the stomach, I aimed a vigorous kick at the cruel master as he stooped to me, and, by chance, the booted foot smashed his glasses, and almost blinded him with their splinters. Starting backward with the excruciating pain, he contrived to stumble over a bench, and the back of his head struck the stone floor; but, as he was in the act of falling, I had bounded to my feet, and possessed myself of his blackthorn. Armed with this, I rushed at the prostrate form, and struck him at random over his body, until I was called to a sense of what I was doing by the stirless way he received the thrashing.

I was exceedingly puzzled what to do now. My rage had vanished, and, instead of triumph, there came a feeling that, perhaps, I ought to have endured, instead of resisting. Some one

suggested that he had better be carried to his study, and we accordingly dragged him along the floor to the master's private room, and I remember well how some of the infants in the fourth room commenced to howl with unreasoning terror.

After the door had been closed on him, a dead silence, comparatively, followed. My wits were engaged in unravelling a way out of the curious dilemma in which I found myself. The overthrow of the master before the school appeared to indicate a new state of things. Having successfully resisted once, it involved a continued resistance, for one would die before submitting again. My friend Mose asked me in a whisper if I knew what was to happen. Was the master dead? The hideous suggestion changed the whole aspect of my thoughts. My heart began to beat as my imagination conjured up unknown consequences of the outrage to authority; and I was in a mood to listen to the promptings of Mose that we should abscond. I assented to his proposal, but, first, I sent a boy to find out the condition of his master, and was relieved to find that he was bathing his face.

Mose and I instantly left the school for the ostensible purpose of washing the blood from my face; but, as a fact, we climbed over the garden wall and dropped into Conway's field, and thence hastened through the high corn in the

Bodfari direction, as though pursued by bloodhounds.

This, then, was the result of the folly and tyranny of Francis. Boys are curious creatures, innocent as angels, proud as princes, spirited as heroes, vain as peacocks, stubborn as donkeys, silly as colts, and emotional as girls. The budding reason is so young and tender that it is unable to govern such composite creatures. Much may be done with kindness, as much may be done with benevolent justice, but undeserved cruelty is almost sure to ruin them.

We ran away with a boundless relief that beyond the walls lay the peopled South that was next to reach Heaven for happiness. The singing birds, the rolling coaches, the tides of joyous intercourse, the family groups, the happy hearths, the smiling welcome of our kind, all lay beyond the gates, and these we fled to meet with the innocence of kids.

[After many hardships he settled for a time with a generous but poverty-stricken uncle in Liverpool, but after a time]:

Fate caused a little incident to occur which settled my course for me. I was sent to the packet-ship, *Windermere*, with a basket of provisions, and a note to Captain David Hardinge. While the great man read his note, I

gazed admiringly at the rich furniture of the cabin, the gilded mirrors, and glittering cornices, and speculated as to the intrinsic value of this gilding, but suddenly I became conscious that I was being scrutinized.

"I see," said the captain, in a strong and rich voice, "that you admire my cabin. How would you like to live in it?"

"Sir?" I answered, astonished.

"I say, how would you like to sail in this ship?"

"But I know nothing of the sea, sir."

"Sho! You will soon learn all that you have to do; and, in time, you may become a captain of as fine a ship. We skippers have all been boys, you know. Come, what do you say to going with me as a cabin-boy? I will give you five dollars a month, and an outfit. In three days we start for New Orleans, to the land of the free and the home of the brave."

All my discontent gathered into a head in a moment, and inspired the answer: "I will go with you, sir, if you think I will suit."

"That's all right. Steward!" he cried; and when the man came, the captain gave him his instructions about me. As he spoke I realized somewhat more clearly what a great step I had taken, and that it was beyond my power to withdraw from it, even if I should wish to do so.

There was no difficulty in obtaining Goff's

consent to quit his service; and the fiendish foreman only gave a sardonic smile which might mean anything. As I strode toward home my feelings varied from spasms of regret to gushes of joy, as I mentally analyzed the coming change. Larded bread and a sordid life with its pawnshops and family bickerings were to be exchanged for full rations and independence. Constant suppression from those who usurped the right to control my actions, words, and thoughts was to be exchanged for the liberty by the rest of the world's toilers. These were the thoughts which pleased me; but when I regarded the other side, a haunting sense of insecurity and foreboding sobered me, and made me unhappy. Then there was a certain feeling of affection for my native land and family. Oh! if my discontent had not been so great, if Uncle Tom had only been more just, I had clung to them like a limpet to a rock! It needed all the force of reason, and the memories of many unhappinesses and innumerable spites, to sever all connection with my humble love, and accept this offer of freedom and release from slavery. The magnitude of the change, and the inevitable sundering of all earthly ties at such short notice, troubled me greatly, but they had no effect in altering my decision.

When the old man reached home and heard

the news, he appeared quite staggered. "What! Going to America!" he exclaimed. "Shipped as a cabin-boy! Come, now, tell me what put that idea into your head? Has anything happened here that I do not know? Eh, wife. how is this?"

His sincere regret made it harder than ever to part. It was in my nature to hate parting. Aunt joined her arguments to those of Uncle Tom to dissuade me. But there rose up before me a great bulk of wretchedness, my slavish dependence on relatives who could scarcely support themselves, my unfortunate employment, Teddy's exasperating insolence, family recriminations, my beggar's wardrobe, and daily diet of contumely; and I looked up from the introspection, and, with fixed resolve, said:

"It is no use, uncle, I must go. There is no chance of doing anything in Liverpool"; and, though he was not of a yielding disposition, uncle consented at last.

In strict justice, however, to his character, I must admit that, had circumstances been equal to his deserving, his nephew would never have been permitted to leave England with his consent; for, according to him, there was no place in all the world like England.

On the third day the *Windermere* was warped out of dock, and then a steam-tug towed her out into mid-river. Shortly after a tug brought

the crew alongside. Sail was loosened, and our ship was drawn toward the ocean, and, as she headed for the sea, the sailors, with rousing choruses, hoisted topsails, and sheeted them home.

When the *Windermere* was deserted by the tug, and she rose and fell to the waves, I became troubled with a strange lightness of the head, and presently I seemed to stand in the centre of a great circle round which sea, and sky, and ship revolved at great speed. Then for three days I lay oblivious, helpless, and grieving; but, at the deck-washing on the fourth morning, I was quickened into sudden life and activity by hearing a hoarse, rasping voice, whose owner seemed in a violent passion, bawling down the scuttle: "Now, then, come out of that, you —— young Britisher! Step up here in a brace of shakes, or I'll come down and skin your —— carcase alive!"

The furious peremptoriness of the voice was enough to rouse the dead, and the fear of the ogre's threats drove all feelings of sickly wretchedness away, and drew me on deck immediately. My nerves tingled, and my senses seemed to swim, as I cast a look at the unsteady sea and uneasy ship; but the strong, penetrating breeze was certainly a powerful tonic, though not such a reviver as the sight of the ireful fellow who came on at a tearing pace toward me and

hissed: "Seize that scrubbing broom, you ——— joskin! Lay hold of it, I say, and scrub, you ——— son of a sea-cook! Scrub like ———! Scrub until you drop! Sweat, you ——— swab! Dig into the deck you ——— ——— white-livered lime juicer!"

I stole the briefest possible glance at his inflamed face, to catch some idea of the man who could work himself into such an intense rage, for he was a kind of creature never dreamed of before by me. Seeing me bend to my task without argument or delay, he darted to another boy on the lee side, and with extreme irony and retracted lips, stooped, with hands on knees, and said to him: "Now, Harry, my lad, I am sure you don't want the toe of my boot to touch ungently those crescents of yours. Do you now?"

"No, sir," said the boy promptly.

"All right, then, my sweet son of a gun. Lay your weight on that broom, and let her rip, d'ye hear?"

"Aye, aye, sir."

Nelson, for that was his name, straightened himself, and cruelly smiling, observed the sailors, who were scrubbing and holy-stoning with exemplary industry, and then moved toward them, discharging salvoes of blasphemies on their heads, of varying force and character. I wondered, as between the tremendous oaths,

I heard the sigh of the sea and the moan of the wind, how long the Almighty would restrain His hand. I scrubbed away until I became heated, but my thoughts were far from my work. I was trying to unravel vague ideas about the oddness of things in this world. It seemed to me surprising that, while so many people on land feared to take the name of God in vain, men on the great sea, surrounded by perils and wonders, could shout aloud their defiance of heaven and hell. There was not a soul on board with whom I could exchange my inner thoughts, and, from this period, I contracted a bit of communing with myself.

At eight bells I was told I belonged to Nelson, the second mate's watch, and that my berth was with Harry, in the apprentice cabin on the main deck. There was no mention of the cabin-boy appointment. When the watch was relieved, Harry and I had a talk. This boy had already made one voyage on the *Windermere*, and, though he despised greenhorns, among whom he classed me, he was pleased to be good-natured with me, probably because I showed such deference to his spirit and experience. He graciously promised to coach me, or, rather, put me "up to the ropes," that I might avoid a few of the punishments mates are so quick to bestow on dull ship-boys.

When I told him that I had been engaged as

cabin-boy, he was uncommonly amused, and said that the skipper was at his old game. "On the last voyage we had two boys who had been induced to join in the same way, but, as soon as we were out to sea, Nelson got a hint from the cap'n and fell on them like a thousand of bricks, and chased them forrard pretty quick, I tell ye. They were bullyragged all the way to New Orleans, and at the pier they sloped, leaving their sea-duds to me. We made a good thing out of the young duffers. The skipper must have cleared twenty-five dollars in wages from the pair of them, the mates had their fun out of them, and I had their toggery.

"What you've got to do is to mind your eye. Look out for Nelson, and be lively. That man ain't no softy, I tell ye. If he comes down on you, you'll get it hot, and no mistake. When he sings out, jump as though you were bitten, and answer, 'Aye, aye, sir.' Never forget to 'sir' him. Whether it's scrubbing, or brass-cleaning, or hauling, stick to your job like ———, and 'sharp's' the word every time. The second mate is bad enough, but Waters, the chief mate, is the very devil. With him the blow goes before the word, while Nelson roars like a true sea-dog before he strikes. Good Lord! I've seen some sights aboard this packet, I have."

"But how did the captain make twenty-five dollars by the boys on the last voyage?"

"How? Well, you *are* a goose! Why, they left their wages, over two months due, in his hands, when they ran away from the ship for fear of worse treatment going home. Aye, that's the ticket, and the size of it, my little matey. Haze and bully the young lubbers well at sea, and they scoot ashore the first chance they get."

"Were the mates not hard on you?"

"Oh, Waters took me into his watch, and showed a liking for me, for, you see, I was not quite a greeny. My father saw me properly shipped, and I signed articles. They didn't, but came aboard with the cap'n's permission, and so did you. The skipper has to account for me when he gets to port; but you, you may be blown overboard, and no one would be the wiser. I am now as good as an ordinary seaman, though too young for the forecastle. I can furl royals as spry as any bucco sailor on board, and know every rope on the ship, while you don't know stem from stern."

These glib nautical phrases, most of which were but vaguely understood by me, his assurance, his daring, his want of feeling, made me admire and wonder at him. He was a typical sea-boy, with a glitter in his eyes and bloom in his smooth cheeks that told of superabundant health and hardiness. But for one thing, a prince might have been proud of him as a son. Satan, I thought, had already adopted him.

His absolute ignorance of religion, his awful coarseness of speech, removed him miles away from me, as though he were a brave young savage of another nation and language, and utterly incomprehensible to me. He was not to be imitated in any way, and yet he obtained my admiration because he had been to America, had manfully endured the tortures of sea-life, and bore himself indomitably.

[After the arrival of the ship at New Orleans he and Harry go ashore.]

After dinner we sauntered through a few streets, in a state of sweet content, and, by and by, entered another house, the proprietress of which was extremely gracious. Harry whispered something to her, and we were shown to a room called a parlour. Presently there bounced in four gay young ladies, in such scant clothing that I was speechless with amazement. My ignorance of their profession was profound, and I was willing enough to be enlightened; but, when they proceeded to take liberties with my person, they seemed to me to be so appallingly wicked that I shook them off and fled out of the house. Harry followed me, and with all the arts he could use tried to induce me to return; but I would as soon have jumped into the gruel-coloured Mississippi as have looked into the

eyes of those giggling wantons again. My disgust was so great that I never, in after years, could overcome my repugnance to females of that character.

Then Harry persuaded me to enter a bar-room, and called for liquor, but here, again, I was obstinate. "Drink yourself, if you like," said I, "but I belong to the Band of Hope and have signed the pledge, so I must not."

"Well, smoke, then; do something like other fellows," he said, offering me my choice.

As I had never heard that smoking was a moral offence, and had a desire to appear manly, I weakly yielded, and, putting a great cigar between my lips, puffed proudly and with vigour. But alas! my punishment was swift. My head seemed to swim, and my limbs were seized with a trembling; and, while vainly trying to control myself, a surge of nausea quite overpowered me, and I tried to steal back to the ship, as abjectly contrite as ever repentant wretch could well be. Thus ended my first night at New Orleans. . . .

That evening I declined to go ashore with Harry, and sat pondering in the loneliness of my cabin, and prayer, somewhat fallen into disuse of late, was remembered; and I rose from my knees primed for the venture. Habit of association, as usual with me, had knit some bonds of attachment between me and the ship.

She connected me with England; by her I came, and by her I could return. Now that was impossible; I must follow the stowaways, and leave the floating hell forever.

I lit the swinging pewter lamp, emptied my sea-bag on the floor, and out of its contents picked my best shore clothes, and the bishop's Bible. I dressed myself with care, and blowing out the lamp, lay down. By and by Harry reeled in, half-stupefied with his excesses, rolled into his bunk above me; and, when he was unconscious, I rose and glided out. Five minutes later I was hurrying rapidly along the riverside of the levee; and, when about a half a mile from the ship, I plunged into the shadows caused by a pile of cotton bales, and lay down to await day-break.

Soon after sunrise I came out of my nest, and after dusting myself, strode toward Tchapitoulas Street.

"The world was all before me where to choose,
And Providence my guide."

The absolutely penniless has a choice of two things: work or starve. No boy of my age and vitality could deliberately choose starvation. The other alternative remained to me, and for work, work of any kind, I was most ready; with a strong belief that it was the only way to achieve

that beautiful independence which sat so well on those who had succeeded. I was quite of the opinion of my Aunt Mary, that "rolling stones gathered no moss," and I wanted permanent work, wherein I could approve myself steady and zealously industrious. Hitherto, I had been most unfortunate in the search. Respectful civility, prompt obedience, and painstaking zeal had been at a discount; but, such is the buoyancy of healthy youth, I still retained my faith that decent employment was within reach of the diligent, and it was this that I was now bent upon.

Hastening across the levee, I entered the great commercial street of the city, at a point not far from St. Thomas Street, and, after a little inward debate, continued down Tchapi-toulas Street, along the sidewalk, with all my senses wideawake. I read every sign reflectively. The store owners' names were mostly foreign, and suggestive of Teutonic and Hibernian origin; but the larger buildings were of undeniable Anglo-Saxon. At the outset, lager-beer saloons were frequent; then followed more shanties, with rusty tin roofs; but, beyond these, the stores were more massive and uniform, and over the doors were the inscriptions, "Produce and Commission Merchants," etc.

As I proceeded, looking keenly about for the favourable chance, the doors were flung open

one by one, and I obtained a view of the interior. Negroes commenced to sweep the long alleys between the goods piles, and to propel the dust and rubbish of the previous day's traffic toward the open gutter. Then flour, whiskey, and rum barrels, marked and branded, were rolled out, and arranged near the kerbstone. Hogsheads and tierces were set on end, cases were built up, sacks were laid in orderly layers, awaiting removal by the drays, which, at a later hour, would convey them to the river-steamers.

Soon after seven I had arrived near the end of the long street; and I could see the colossal custom-house, and its immense scaffolding. So far, I had not addressed myself to a single soul, and I was thinking I should have to search in another street, when just at this time I saw a gentleman of middle age seated in front of No. 3 store, reading a morning newspaper. From his sober, dark alpaca suit and tall hat, I took him to be the proprietor of the building, over the door of which was the sign, "Speake & McCreery, Wholesale and Commission Merchants." He sat tilted back against what appeared to be the solid granite frame of the door, with a leisured ease which was a contrast to the activity I had previously noticed. After a second look at the respectable figure and genial face, I ventured to ask:

"Do you want a boy, sir?"

"Eh?" he demanded with a start; "what did you say?"

"I want some work, sir; I asked if you wanted a boy."

"A boy," he replied slowly, and fixedly regarding me. "No, I do not think I want one. What should I want a boy for? Where do you hail from? You are not an American."

"I came from Liverpool, sir, less than a week ago, by a packet-ship. I shipped as cabin-boy, but, when we got to sea, I was sent forward, and, until last night, I was abused the whole voyage. At last I became convinced that I was not wanted, and left. As you are the first gentleman I have seen, I thought I would apply to you for work, or ask you for advice as to how to get it."

"So!" he ejaculated, tilting his chair back again. "You are friendless, in a strange land, eh, and want work to begin making your fortune, eh? Well, what work can you do? Can you read? What book is that in your pocket?"

"It is my Bible, a present from our bishop. Oh, yes, sir, I can read," I replied proudly.

He held out his hand and said: "Let me see your Bible."

He opened it at the fly-leaves, and smiled as he read the inscription, "Presented to John Rowlands by the Right Revd. Thomas Vowler

Short, D. D., Lord Bishop of St. Asaph, for diligent application to his studies, and general good conduct. January 5th, 1855."

Returning it to me, he pointed to an article in his newspaper, and said, "Read that." It was something about a legislative assembly, which I delivered, as he said, "very correctly, but with an un-American accent."

"Can you write well?" he next asked.

"Yes, sir, a good round hand, as I have been told."

"Then let me see you mark that coffee-sack with the same address you see on the one near it. There is the marking-pot and brush."

In a few seconds I had traced "S *Memphis, Tenn.*," and looked up.

"Neatly done," he said; "now proceed and mark the other sacks in the same way."

There were about twenty of them, and in a few minutes they were all addressed.

"Excellent!" he cried; "even better than I could do it myself. There is no chance of my coffee getting lost this time! Well, I must see what can be done for you. Dan!" he cried to a darky indoors, "when is Mr. Speake likely to be in?"

"'Bout nine, sah; mebbe a leetle aftah."

"Oh, well," said he, looking at his watch, "we have ample time before us. As I don't suppose you have breakfasted yet, you had

better come along with me. Take the paper, Dan."

We turned down the next street, and as we went along he said first impressions were very important in this world, and he feared that if his friend James Speake had seen cotton fluff and dust on my jacket, and my uncombed hair, he might not be tempted to look at me twice, or care to trust me among his groceries; but, after a breakfast, a hair cut, and a good clean-up, he thought I would have a better chance of being employed.

I was taken to a restaurant, where I was provided with superb coffee, sugared waffles, and doughnuts, after which we adjourned to a basement distinguished by a pole with red, white, and blue paint.

Every one who has been operated upon by an American barber will understand the delight I felt as I lay submissive in the luxurious chair, to be beautified by a demi-semi-gentleman, with ambrosial curls! The mere fact that such as he condescended to practise his art upon one who but yesterday was only thought worthy of a kick, gave an increased value to my person, and provoked my conceit. When my dark hair had been artistically shortened, my head and neck shampooed, and my face glowed with the scouring, I looked into the mirror and my vanity was prodigious. A negro boy completed my

toilet with an efficient brushing and a boot-polish, and my friend was pleased to say that I looked first-rate.

By the time we returned to Speake & McCreery's store, Mr. James Speake had put in an appearance. After a cordial greeting, my benefactor led Mr. Speake away by the arm and held a few minutes' earnest conversation with him. Presently I was beckoned to advance, and Mr. Speake said with a smile to me:

"Well, young man, this gentleman tells me you want a place. Is that so?"

"Yes, sir."

"That is all right. I am willing to give you a week's trial at five dollars, and if we then find we suit each other, the place will be permanent. Are you agreeable?"

There could be no doubt of that fact, and Mr. Speake turned round to two young gentlemen, one of whom he called Mr. Kennicy, and the other Mr. Richardson, and acquainted them with my engagement as a help to Mr. Richardson in the shipping business. The generosity of my unknown friend had been so great that, before addressing myself to any employment, I endeavoured to express my gratitude; but my strong emotions were not favourable to spontaneous fluency. The gentleman seemed to divine what I wished to say, and said:

"There, that will do. I know what is in

your heart. Shake hands. I am going up-river with my consignments, but I shall return shortly and hope to hear the best accounts of you."

For the first half-hour my heart was too full, and my eyes too much blurred, to be particularly bright. The gentleman's benevolence had been immense, and as yet I knew not even his name, his business, or what connection he had with the store of Speake and McCreery. I was in the midst of strangers, and, so far, my experience of them had not been of that quality to inspire confidence. In a short time, however, Mr. Richardson's frankness and geniality made me more cheerful. He appeared to take pride in inducting me into my duties, and I responded with alacrity. He had an extremely pleasant manner, the candour of Harry, without his vulgarity. Before an hour had passed, I was looking up to him as to a big brother, and was asking him all sorts of questions respecting the gentleman who had taken me out of the street and started me so pleasantly in life.

From Mr. Richardson I learned that he was a kind of broker who dealt between planters up-river and merchants in New Orleans, and traded through a brother with Havana and other West Indian ports. He had a desk in the store, which he made use of when in town,

and did a good deal of safe business in produce both with Mr. Speake and other wholesale merchants. He travelled much up and down the river, taking large consignments with him for back settlements up the Arkansas, Washita, and Saline, and other rivers, and returning often with cotton and other articles. *His name was MR. STANLEY.*

[Thus the young cabin-boy gained his first real start in life. Mr. Stanley recognized his worth, eventually adopted him as a son, and endowed him with his own name, which the young recipient was one day to make illustrious.]

THOMAS A. EDISON
(1847-)

THOMAS A. EDISON

**"GENIUS IS NINETY-EIGHT PER CENT.
PERSPIRATION"**

THE greatest inventor of modern times is a believer in the ability of the average man, *plus hard work*. As he phrases it, "Genius is two per cent. inspiration and ninety-eight per cent. perspiration."

The story of his early life and of some of his most important inventions is told in his own words in the following pages:

*While a newsboy on the railroad I got very much interested in electricity, probably from visiting telegraph offices with a chum who had tastes similar to my own. We ran a telegraph line between our respective houses, supporting the wire on trees and insulating it by the necks of bottles. We learned how to "send" and "take," and got a lot of fun out of it when we were not on the run. But my spare time was limited, for just as soon as I commenced making experiments with the instruments each night I would hear my father's voice ordering me to

*From various sources.

bed. At that time what he said was law, and if I tried to sneak a few hours up in the workshop he would come in and take the light away. So I had to think of the best way to overcome his prejudice to late study.

Each evening I would come in with a bunch of papers that I had not sold, and my father would start in to read them, and I had to go to bed, while he sat up till midnight reading the news. But he never became so absorbed that he failed to hear 9:30 chime, though frequently I gave him long, interesting articles to read, hoping that it would take his mind off the time. But it was no good; as the half-hour approached his eye would wander toward the clock, and at the tick I would hear his voice yelling to me to go to bed, and off I went. But one day on the train my chum and I concocted a plan whereby we hoped to break down this foolish rule. That night I didn't bring any papers home, and when my father asked me for one I said: "Dick's got them all. He took them to his house. His folks wanted them." That took him back a bit, but I didn't say any more until I was going to bed, and then I made a suggestion. "Dick and I have a telegraph line working between our rooms," I said, "maybe I could call him up and get the news by wire." Well, my father was quite agreeable, though probably a little dubious about

our ability, but I went to work and everything turned out all right.

I called on Dick, and he sat at the other end of the wire with a paper in front of him sending the news, while I took it on slips of paper, handing them over to my father to read as fast as each item was finished. There I sat until after 11 o'clock, feeding my father the news in broken doses and getting a lot of amusement and telegraphic practice out of it. This went on every night for some time, until my father was quite persuaded that I could stay up late without serious harm. And then I began bringing papers home again and put my extra time allowance on my experiments. . . .

[A short time ago Edison was asked to explain his connection with the telephone, and with his usual modesty he replied:]

“When I struck the telephone business the Bell people had no transmitter, but were talking into the magneto receiver. You never heard such a noise and buzzing as there was in that old machine! I went to work and monkeyed around, and finally struck the notion of the lampblack button. The Western Union Telegraph Company thought this was a first-rate scheme, and bought the thing out, but afterward

they consolidated, and I quit the telephone business. . . .”

[The genesis of the electric light is thus given in Edison's own simple words:]

In 1878 I went down to see Professor Barker, at Philadelphia, and he showed me an arc lamp—the first I had seen. Then a little later I saw another—I think it was one of Brush's make—and the whole outfit, engine, dynamo, and one or two lamps, was travelling around the country with a circus. At that time Wallace and Moses G. Farmer had succeeded in getting ten or fifteen lamps to burn together in a series, which was considered a very wonderful thing. It happened that at the time I was more or less at leisure, because I had just finished working on the carbon-button telephone, and this electric-light idea took possession of me. It was easy to see what the thing needed: it wanted to be subdivided. The light was too bright and too big. What we wished for was little lights, and a distribution of them to people's houses in a manner similar to gas. Governor P. Lowry thought that perhaps I could succeed in solving the problem, and he raised a little money and formed the Edison Electric Light Company. The way we worked was that I got a certain sum of money a week and employed a certain

number of men, and we went ahead to see what we could do.

We soon saw that the subdivision never could be accomplished unless each light was independent of every other. Now it was plain enough that they could not burn in series. Hence they must burn in multiple arc. It was with this conviction that I started. I was fired with the idea of the incandescent lamp as opposed to the arc lamp, so I went to work and got some very fine platinum wire drawn. Experiment with this, however, resulted in failure, and then we tried mixing in with the platinum about 10 per cent. of iridium, but we could not force that high enough without melting it. After that came a lot of experimenting, covering the wire with oxide of cerium and a number of other things.

Then I got a great idea. I took a cylinder of zirconia and wound about a hundred feet of the fine platinum wire on it coated with magnesia from the syrupy acetate. What I was after was getting a high-resistance lamp, and I made one that way that worked up to 40 ohms. But the oxide developed the phenomena now familiar to electricians, and the lamp short-circuited itself. After that we went fishing around and trying all sorts of shapes and things to make a filament that would stand. We tried silicon and boron, and a lot of things that I have forgotten now. The funny part of it was that

I never thought in those days that a carbon filament would answer, because a fine hair of carbon was so sensitive to oxidation. Finally, I thought I would try it because we had got very high vacua and good conditions for it.

Well, we sent out and bought some cotton thread, carbonized it, and made the first filament. We had already managed to get pretty high vacua, and we thought, maybe, the filament would be stable. We built the lamp and turned on the current. It lit up, and in the first few breathless minutes we measured its resistance quickly and found it was 275 ohms—all we wanted. Then we sat down and looked at that lamp. We wanted to see how long it would burn. The problem was solved—if the filament would last. The day was—let me see—October 21, 1879. We sat and looked, and the lamp continued to burn, and the longer it burned the more fascinated we were. None of us could go to bed, and there was no sleep for any of us for forty hours. We sat and just watched it with anxiety growing into elation. It lasted about forty-five hours, and then I said, "If it will burn that number of hours now, I know I can make it burn a hundred." We saw that carbon was what we wanted, and the next question was what kind of carbon. I began to try various things, and finally I carbonized a strip of bamboo from a Japanese fan, and saw

that I was on the right track. But we had a rare hunt finding the real thing. I sent a school-master to Sumatra and another fellow up the Amazon, while William H. Moore, one of my associates, went to Japan and got what we wanted there. We made a contract with an old Jap to supply us with the proper fibre, and that man went to work and cultivated and cross-fertilized bamboo until he got exactly the quality we required. One man went down to Havana, and the day he got there he was seized with yellow fever and died in the afternoon. When I read the cable message to the boys, about a dozen of them jumped up and asked for his job. Those fellows were a bright lot of chaps, and sometimes it was hard to select the right ones. . . .

[There arose the problem how to distribute the current. After some further experimentation, Edison wrote:]

“There is no difficulty about dividing up the current and using small quantities at different points. The trouble is in finding a candle that will give a pleasant light, not too intense, which can be turned off and on as easily as gas. Such a candle cannot be made from carbon points, which waste away, and must be regulated constantly while they do last. Some composition

must be discovered which will be luminous when charged with electricity and that will not wear away. Platinum wire gives good light when a certain quantity of electricity is passed through it. If the current is made too strong, however, the wire will melt. I want to get something better. I have a chemist at work helping me to find the composition that will be made luminous by electricity. We shall discover it in time. . . .”

[Referring to the difficulty he and his assistant had in placing the carbonized cotton they had experimented with in the first electric bulb, Edison writes:]

“All night Bachelor, my assistant, worked beside me. The next day and the next night again, and at the end of that time we had produced one carbon out of an entire spool of Clarke’s thread. Having made it, it was necessary to take it to the glass-blower’s house. With the utmost precaution Bachelor took up the precious carbon, and I marched after him, as if guarding a mighty treasure. To our consternation, just as we reached the glass-blower’s bench, the wretched carbon broke. We turned back to the main laboratory and set to work again. It was late in the afternoon before we had produced another carbon, which was again broken

by a jeweller's screw-driver falling against it. But we turned back again, and before night the carbon was completed and inserted in the lamp. The bulb was exhausted of air and sealed, the current turned on, and the sight we had so long desired to see met our eyes."

[After this Edison desired a central station "from which consumers might obtain their electric light in the same way that they drew their gas."]

I had the central station idea in my mind all the time that I was pursuing my investigations in electric lighting. I got an insurance map of New York, in which every elevator shaft and boiler and house-top and fire-wall was set down, and studied it carefully. Then I laid out a district and figured out an idea of the central station to feed that part of the town from just south of Wall Street up to Canal and over from Broadway to the East River. I worked on a system, and soon knew where every hatchway and bulkhead door in the district I had marked was, and what every man paid for his gas. How did I know? Simplest thing in the world. I hired a man to start in every day about 2 o'clock and walk around through the district noting the number of gas lights burning in the various premises; then at three o'clock he went around

again and made more notes, and at four o'clock and up to every other hour to two or three o'clock in the morning. In that way it was easy enough to figure out the gas consumption of every tenant and of the whole district; other men took other sections.

After various other preliminaries we were fairly committed to the lighting project and started in to build the central station. You cannot imagine how hard it was. There was nothing that we could buy or that anybody else could make for us. We built the thing with our hands, as it were. At Menlo Park we started a lamp factory. Krusei was set to work making the tubes over in Washington Street, and we hired a kind of a second-class machine shop in Goerck Street and there started out making the dynamos, while Bergmann had a little place on the East Side where he made gas fixtures, and he went into making sockets and fixtures for us and did well with them. We started with our own money and credit—mostly credit. But we soon got the money put up for the station by starting the New York Edison Illuminating Company.

I planned out the station and found where it ought to go, but we could not get real estate where it was wanted. It cost us \$150,000 for two old buildings down in Pearl Street where we finally settled. We had very little room and

we wanted a big output. There was nothing else for it but to get high-speed engines, and there were no high-speed engines in those days. I had conceived the idea of a direct-coupled machine, and wanted to hitch the dynamo direct to the engine without belting. I could not see why, if a locomotive could run on that speed, a 150-horsepower engine could not be made to run 350 turns a minute. The engine builders, when I asked them about it, held up their hands and said, "Impossible!" I didn't think so. I found C. H. Porter, and I said to him: "Mr. Porter, I want a 150-horsepower engine to run 700 revolutions per minute." He hummed and hawed a little while, and then agreed to build it—if I could pay for it! I believe he charged me \$4,200 for it. He got it finished and sent it out to the Park.

We set the machine up in the old shop, and we had some idea of what might happen. So we tied a chain around the throttle valve and ran it out through a window into the woodshed, where we stood to work it. Now the old shop stood on one of those New Jersey shale hills, and every time we opened up the engine and she got to about 300 revolutions the whole hill shook under her. We shut her off and rebalanced and tried again, and after a good deal of trouble we finally did run up to 700, but you should have seen her run! Why, every time

the connecting rod went up she tried to lift that whole hill with her! After we got through with this business we tamed her down to 350 revolutions (which was all I wanted), and then everybody said: "Why, how beautifully it runs, and how practicable such an engine is!" We closed a bill for six engines, and I went to work in Goerck Street to build the dynamos on to them. Of course, we built them by guess-work. I guessed at 110 volts—and I didn't guess enough. So we put extra pole-pieces on them, and in that way managed to raise the voltage to what I wanted.

While all this was going on in the shop we had dug ditches and laid mains all around the district. I used to sleep nights on piles of pipes in the station, and I saw every box poured and every connection made on the whole job. There was nobody else who could superintend it. Finally we got our feeders all down and started to put on an engine and turn over one of the machines to see how things were. My heart was in my mouth at first, but everything worked all right, and we had more than 500 ohms insulation resistance. Then we started another engine and threw them in parallel. Of all the circuses since Adam was born we had the worst then. One engine would stop and the other would run up to about a thousand revolutions, and then they would see-saw.

What was the matter? Why, it was those Porter governors! When the circus commenced the men who were standing around ran out precipitately, and some of them kept running for a block or two. I grabbed the throttle of one engine and E. H. Johnson, who was the only one present to keep his wits, caught hold of the other and we shut them off. Of course I discovered then that what happened was that one set was running the other one as a motor. I then put up a long shaft connecting all the governors together, and thought this would certainly cure the trouble, but it didn't. The torsion of the shaft was so great that one governor still managed to get ahead of the others. Then I went to Goerck Street and got a piece of shafting and a tube in which it fitted. I twisted the shaft one way and the tube the other as far as I could and pinned them together. In this way, by straining the whole outfit up to its elastic limit in opposite directions, the torsion was practically eliminated, and after that the governors ran together all right.

About that time I got hold of Gardiner C. Sims, and he undertook to build an engine to run at 350 revolutions and give 175 horsepower. He went back to Providence and set to work and brought the engine back with him. It worked but only a few minutes, when it busted.

That man sat around the shop and slept in it for three weeks until he got his engine right and made it work the way we wanted it to. When he reached this period I gave orders for the works to run night and day until we got enough engines, and when all was ready we started the engine. The date was September 4, 1882, a Saturday night. That was when we first turned the current on to the mains for regular light distribution, and it stayed on for eight years with only one insignificant stoppage. One of these engines that Sims built ran twenty-four hours a day for 365 days before it was stopped.

In those days we used the old chemical meters, and these gave us a lot of trouble, for, as they contained two jars of a liquid solution, there was always a danger of freezing in the cold weather. So I set to work to negative this difficulty and succeeded, as I thought, by putting an incandescent lamp in each meter with a thermostat strip, which would make a contact through the lamp when the temperature fell to 40 degrees. That idea, simple as it was, caused us a whole lot of trouble. The weather became cold, and then the telephone in our office began to ring every five minutes and people would say:

"Our meter's red hot. Is that all right?"

Then some one else would call up and say:

"Our meter's on fire inside, and we poured water on it. Did that hurt it?"

As to voltmeters, we didn't have any. We used lamps. And I hadn't much use for mathematicians either, for I soon found that I could guess a good deal closer than they could figure, so I went on guessing. We used to hang up a shingle nail, tie it on a string alongside one of the feeders, and used that for a heavy current ammeter. It worked all right. When the nail came close to the feeder we screwed up the rheostat a little, and in this way kept the lamps looking about right.

I invented the fuse wire about the time of the aldermen's visit to Menlo Park. It had occurred to me that an interruption would be serious, and I had thought out the scheme of putting some fine copper wire in as fuses in various places. And when the aldermen came one fellow in the party who had a little piece of heavy wire in his hand managed to short-circuit the mains with his wire. He was very much surprised because only three lamps went out. The real reason that led me to think of the fuse wire was that we were not very flush of dynamos in those days. I had burned out two or three, and I saw that something was needed to prevent that happening again. After my experience with my short-circuiting friend, I had fuses put in all over. . . .

[In the *North American Review* Mr. Edison gave the following account of his invention of the phonograph:]

In the phonograph we find an illustration of the truth that human speech is governed by the laws of number, harmony, and rhythm. And by these laws we are now able to register all sorts of sounds and all articulating utterances—even to the lightest shades and variations of the voice—in lines or dots which are an absolute equivalent for the emission of sound by the lips; so that, through this contrivance, we can cause these lines and dots to give forth again the sound of the voice, of music, and all other sounds recorded by them, whether audible or inaudible. For it is a very extraordinary fact that, while the deepest tone that our ears are capable of recognizing is one containing sixteen vibrations a second, the phonograph will record ten or less, and can then raise the pitch until we hear a reproduction of them. Similarly, vibrations above the highest rate audible to the ear can be recorded by the phonograph and then reproduced by lowering the pitch until we actually hear the record of these inaudible pulsations.

To make the idea of the recording of sound more clear, let me remark one or two points. We have all been struck by the precision with

which even the faintest sea waves impress upon the surface of a beach the fine, sinuous line which is formed by the rippling edge of their advance. Almost as familiar is the fact that grains of sand sprinkled on a smooth surface of glass or wood on or near a piano sift themselves into various lines and curves according to the vibrations of the melody played on the piano keys. These things indicate how easily the particles of solid matter may receive an imparted motion, or take an impression, from delicate liquid waves, air waves, or waves of sound. Yet, well known though these phenomena were, they apparently never suggested until within a few years that the sound waves set going by a human voice might be so directed as to trace an impression upon some solid substance with a nicety equal to that of the tide recording its flow upon a sand beach.

My own discovery that this could be done came to me almost accidentally while I was busy with experiments having a different object in view. I was engaged upon a machine intended to repeat Morse characters which were recorded on paper by indentations that transferred their message to another circuit automatically when passed under a tracing-point connected with a circuit-closing apparatus. In manipulating this machine I found that when the cylinder carrying the indented paper was turned with great swiftness, it gave off a humming noise

from the indentations—a musical, rhythmic sound resembling that of human talk heard indistinctly. This led me to try fitting a diaphragm to the machine, which would receive the vibrations or sound waves made by my voice when I talked to it, and register these vibrations upon an impressible material placed on the cylinder. The material selected for immediate use was paraffined paper, and the results obtained were excellent. The indentations on the cylinder, when rapidly revolved, caused a repetition of the original vibrations to reach the ear through a recorder, just as if the machine itself were speaking. I saw at once that the problem of registering human speech so that it could be repeated by mechanical means as often as might be desired was solved.

ROBERT E. PEARY
(1856-)



ROBERT E. PEARY

WHY HE REACHED THE NORTH POLE

HENCEFORTH, when men think of *Perseverance* they will do honor to the name of *Peary*, the man who for twenty-three years, in spite of hardship unspeakable, returned again and yet again to the task he had set himself, till the end crowned the work and his desire was accomplished.

ESSENTIALS THAT BROUGHT SUCCESS*

Something has already been said regarding the fact that our journey to the North Pole was no haphazard, hit or miss "dash." It was not really a "dash" at all. Perhaps it may properly be described as a "drive"—in the sense that when the sledge journey got under way we pressed forward with a speed at times almost breathless. But nothing was done impulsively. Everything was done in accordance with a scheme long contemplated and plotted out in advance with every possible care.

*From "The North Pole," by Robert E. Peary. F. A. Stokes Co., 1910.

The source of our success was a carefully planned system, mathematically demonstrated. Everything that could be controlled was controlled, and the indeterminate factors of storms, open leads, and accidents to men, dogs, and sledges, were taken into consideration in the percentage of probabilities and provided for as far as possible. Sledges would break and dogs would fall by the way, of course; but we could generally make one sledge out of two broken ones, and the gradual depletion of the dogs was involved in my calculations.

The so-called "Peary system" is too complex to be covered in a paragraph, and involves too many technical details to be outlined fully in any popular narrative. But the main points of it are about as follows:

To drive a ship through the ice to the farthest possible northern land base from which she can be driven back again the following year.

To do enough hunting during the fall and winter to keep the party healthily supplied with fresh meat.

To have dogs enough to allow for the loss of sixty per cent. of them by death or otherwise.

To have the confidence of a large number of Eskimos, earned by square dealing and generous gifts in the past, so that they will follow the leader to any point he may specify.

To have an intelligent and willing body of civilized assistants to lead the various divisions of Eskimos—men whose authority the Eskimos will accept when delegated by the leader.

To transport beforehand to the point where the expedition leaves the land for the sledge journey, sufficient food, fuel, clothing, stoves (oil or alcohol), and other mechanical equipment to get the main party to the Pole and back and the various divisions in their farthest north and back.

To have an ample supply of the best kind of sledges.

To have a sufficient number of divisions, or relay parties, each under the leadership of a competent assistant, to send back at appropriate and carefully calculated stages along the upward journey.

To have every item of equipment of the quality best suited to the purpose, thoroughly tested, and of the lightest possible weight.

To know, by long experience, the best way to cross wide leads of open water.

To return by the same route followed on the upward march, using the beaten trail and the already constructed igloos to save the time and strength that would have been expended in constructing new igloos and in trail-breaking.

To know exactly to what extent each man and dog may be worked without injury.

To know the physical and mental capabilities of every assistant and Eskimo.

Last, but not least, to have the absolute confidence of every member of the party, white, black, or brown, so that every order of the leader will be implicitly obeyed. . . .

It may not be inapt to liken the attainment of the North Pole to the winning of a game of chess, in which all the various moves leading to a favourable conclusion had been planned in advance, long before the actual game begun. It was an old game for me—a game which I had been playing for twenty-three years, with varying fortunes. Always, it is true, I had been beaten, but with every defeat came fresh knowledge of the game, its intricacies, its difficulties, its subtleties, and with every fresh attempt success came a trifle nearer; what had before appeared either impossible, or, at the best, extremely dubious, began to take on an aspect of possibility, and, at last, even of probability. Every defeat was analyzed as to its causes in all their bearings, until it became possible to believe that those causes could in future be guarded against and that, with a fair amount of good fortune, the losing game of nearly a quarter of a century could be turned into one final, complete success.

It is true that with this conclusion many well-informed and intelligent persons saw fit to differ.

But many others shared my views and gave without stint their sympathy and their help, and now, in the end, one of my greatest unalloyed pleasures is to know that their confidence, subjected as it was to many trials, was not misplaced, that their trust, their belief in me and in the mission to which the best years of my life have been given, have been abundantly justified.

But while it is true that as far as plan and method are concerned the discovery of the North Pole may fairly be likened to a game of chess, there is, of course, this obvious difference: in chess, brains are matched against brains. In the quest of the Pole it was a struggle of human brains and persistence against the blind, brute forces of the elements of primeval matter, acting often under laws and impulses almost unknown or but little understood by us, and thus many times seemingly capricious, freaky, not to be foretold with any degree of certainty. For this reason, while it was possible to plan, before the hour of sailing from New York, the principal moves of the attack upon the frozen North, it was not possible to anticipate all of the moves of the adversary. Had this been possible, my expedition of 1905-1906, which established the then "farthest north" record of $87^{\circ} 6'$, would have reached the Pole. But everybody familiar with the records of that expedition knows that

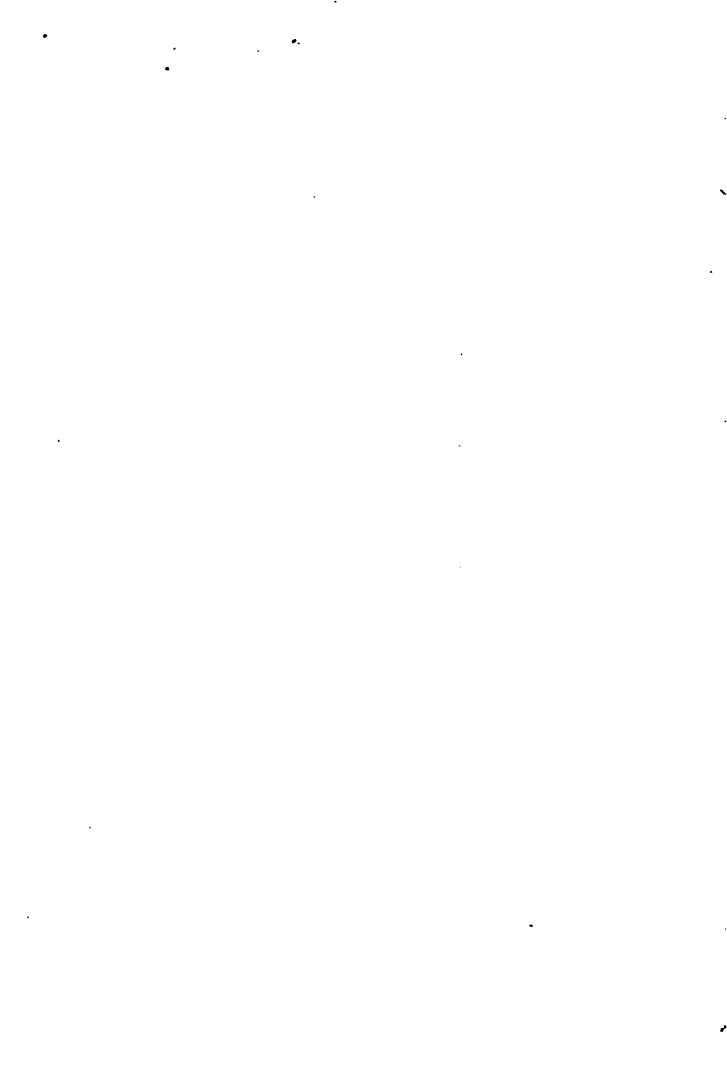
its complete success was frustrated by one of those unforeseen moves of our great adversary—in that a season of unusually violent and continued winds disrupted the polar pack, separating me from my supporting parties with insufficient supplies, so that, when almost within striking distance of the goal, it was necessary to turn back because of the imminent peril of starvation.

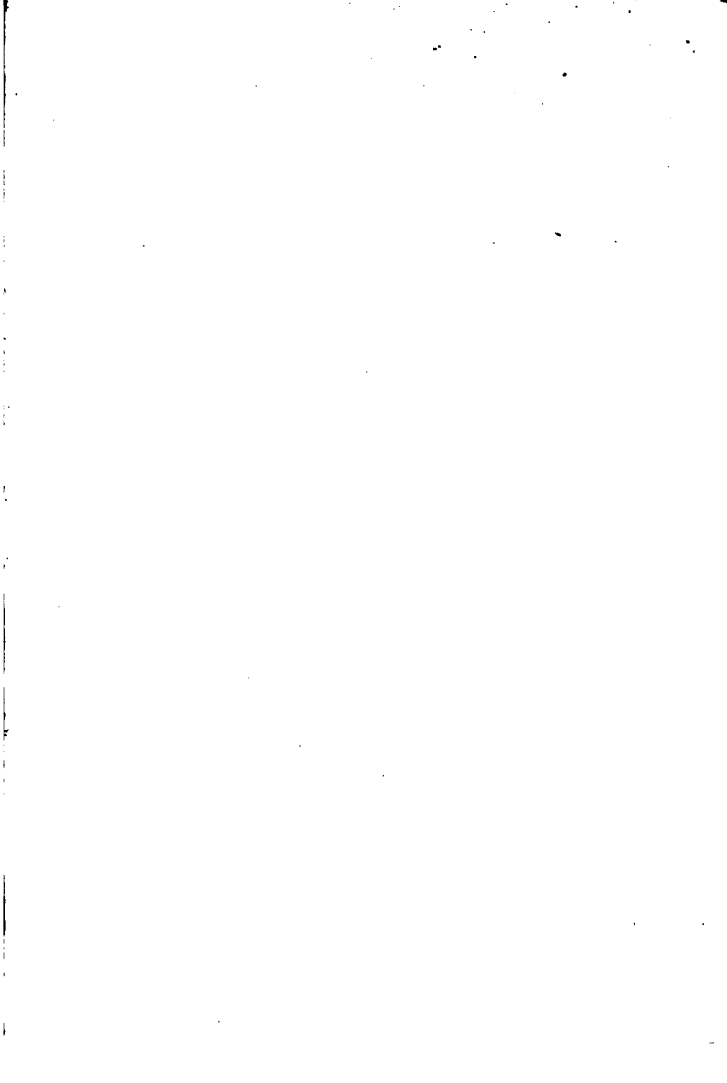
When victory seemed at last almost within reach, I was blocked by a move which could not possibly have been foreseen, and which, when I encountered it, I was helpless to meet. And, as is well known, I and those with me were not only checkmated but very nearly lost our lives as well.

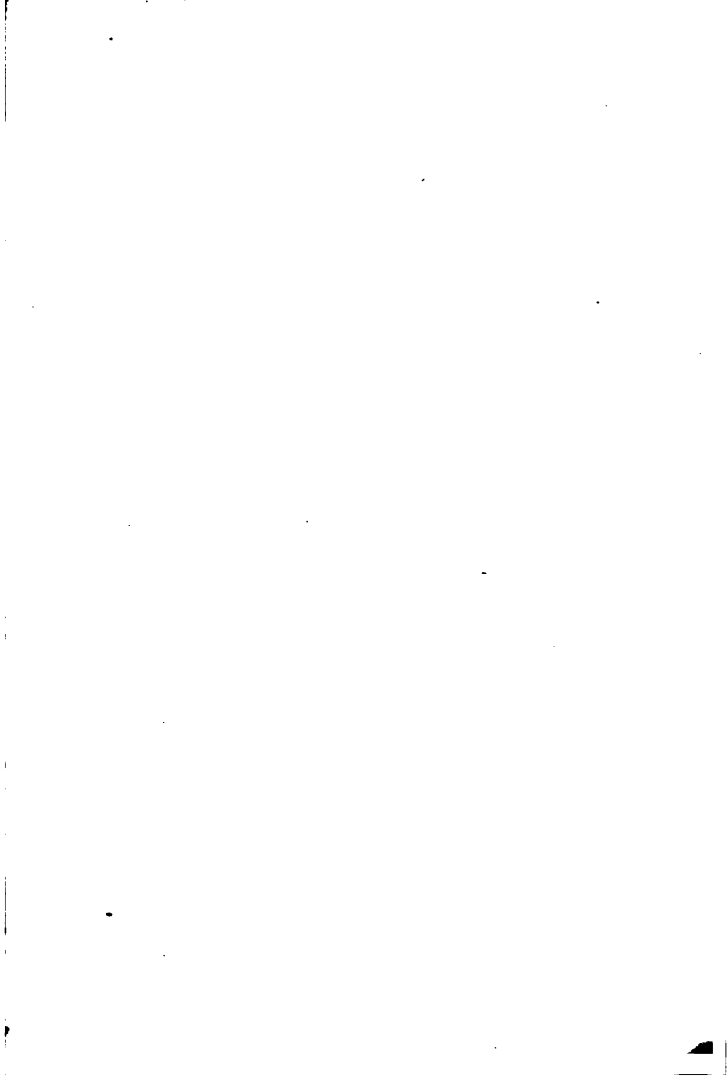
But all that is now as a tale that is told. This time it is a different and perhaps a more inspiring story, though the records of gallant defeat are not without their inspiration. And the point which it seems fit to make in the beginning is that success crowned the efforts of years because strength came from repeated defeats, wisdom from earlier error, experience from inexperience, and determination from them all.



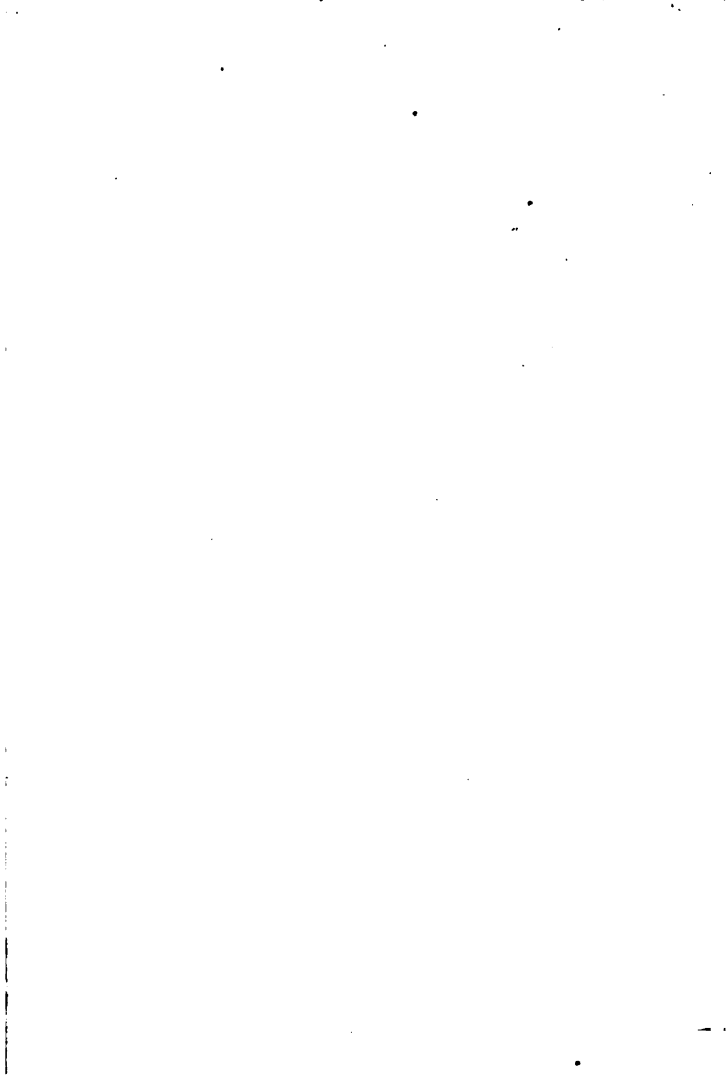
THE COUNTRY LIFE PRESS
GARDEN CITY, N. Y.

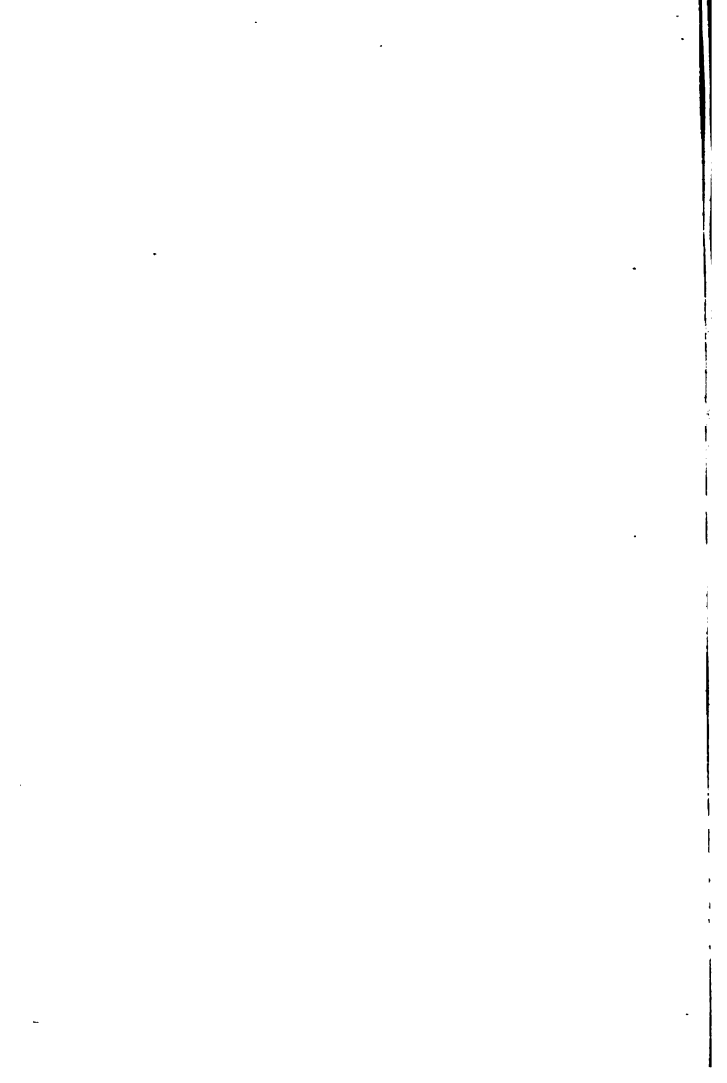




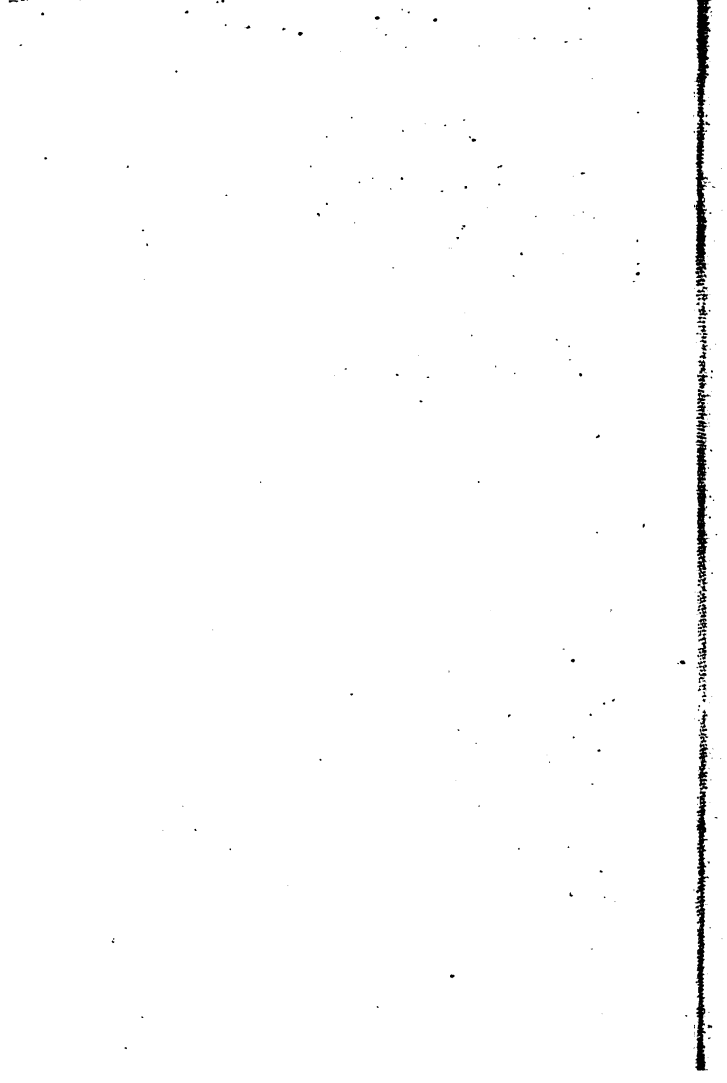


gw
K. J.





[illegible]



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